CHEMICAL
& METALLURGICAL
# ENGINEERING

Fourteenth Chemical Exposition Number

Contents for November, 1933

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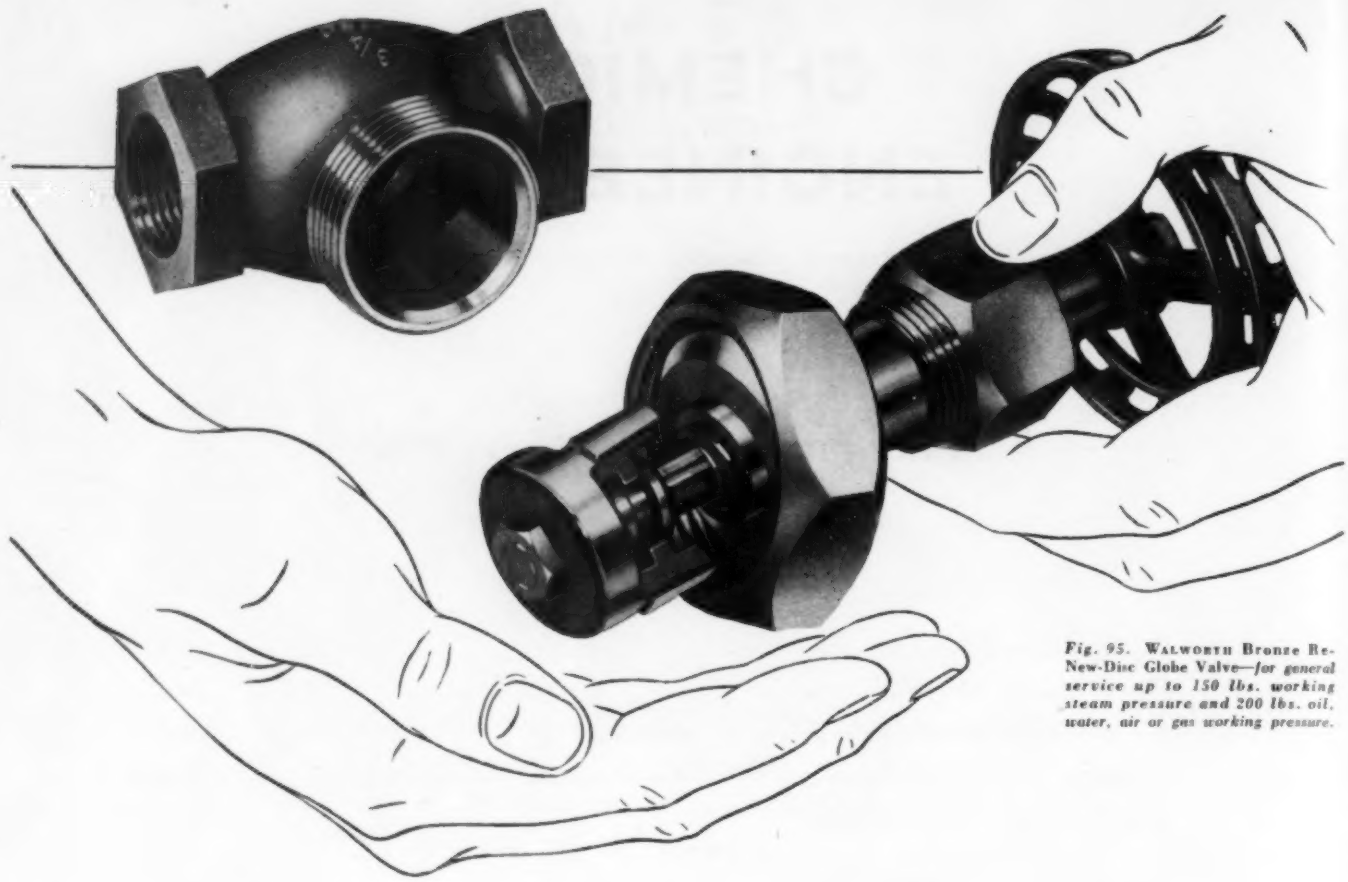

Fig. 95. WALWORTH Bronze Re-New-Disc Globe Valve—for general service up to 150 lbs. working steam pressure and 200 lbs. oil, water, air or gas working pressure.

CHEMICAL
& METALLURGICAL
ENGINEERING

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S. D. KIRKPATRICK, Editor

NOVEMBER, 1933

Balance Wheel of Industry

ONE NEED BUT GLANCE at the recent earnings of chemical companies to appreciate the fact that as a group of industries they possess a marked degree of stability. All through the depression they have held to a fairly level course, resisting the violent swings to panic depths or to speculative heights. Wherein lies the reason? Is it because of a careful management that can "restrict the feast in order to eliminate the famine"? Or is it inherent in the nature of a basic industry with a diversified market for its products? To some extent it is both, but underlying both is the stabilizing influence of a creative technology.

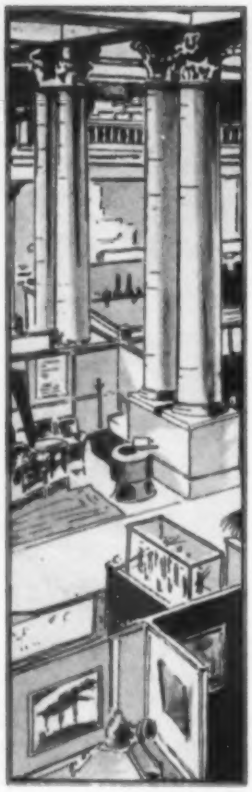
Chemical engineering serves as a great balance wheel for the process industries. It absorbs the surges, compensates for the slumps, carries on at a steady pace. Behind it is the motivating forces of research, pent-up energy in the form of ideas to be converted into new products and processes. Ahead is only the resistance of tradition, opposing change yet forced to make way for scientific progress. Achievement in chemical industries is not so much the single spectacular feat as it is the steady advance in a definite direction. It is a broad program and plan rather than a favorable but temporary turn of fortune.

So in this issue of *Chem. & Met.* it is our privilege to describe a great program of advance that has led to the building of a whole new branch of chemical industry in America. It has been judged the outstanding chemical engineering achievement of the depression era. It affords ample evidence of both the creative and stabilizing influences of technology.

IN THE DAYS immediately ahead, all industry is going to need more of this sort of contribution from the chemical engineer. The program of the industrial recovery is broader than any present campaign for increasing employment and building buying power. It calls for a re-appraisal of motives and objectives and a revamping of the methods and machinery by which these are attained. This process extends through every function of industry—management, maintenance, construction, production, equipment, power, control, accounting and sales. Each of these receives authoritative treatment in the series of articles on industrial recovery which also feature this Chemical Exposition Number.

The whole is presented as timely evidence that chemical engineering can and will carry on its steady progress toward even greater achievement.

CHEMICAL ENGINEERING



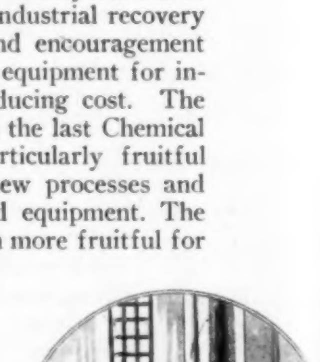
The CHEMICAL SHOW

MOST MEN have difficulty in visualizing that which they have never experienced. Hence there is the natural desire to see, to compare and appraise—in short, actually to experience. Education through the eye is always the most effective. What we see is more likely to stick with us than what we read or hear. This is, of course, primarily the appeal of the industrial exhibit or exposition and doubtless accounts for its popularity in so many fields of human activity. But it seems to us that the Chemical Exposition carries experience a step further. It adds the factor of imagination in portraying the trends in the rapidly changing course of chemical engineering progress. It is a real look into the future.

IN THE EARLY days of the Chemical Show every effort was made to attract and capitalize the interest of the layman. The chemical industry was just developing in this country and sorely needed the financial and moral support of the general public. But as those objectives were gradually attained, emphasis shifted to a less numerous but more attentive audience of technical men. To them the Exposition became a part of their very livelihood. It dealt with improvements in production methods and machinery in which they had a vital interest. It gave them the opportunity to become acquainted not only with the new tools of industry but with the men responsible for their development and improvement.

It is this close relationship between the chemical engineer and the equipment manufacturer that the Chemical Show can do most to promote. For many reasons these two complementary factors should work in happy accord, with full recognition of the specialized ability and responsibilities of each. The chemical engineer in the plant may know more about his manufacturing process as a whole than anyone else, yet it is probable that he knows less about each individual step or operation than the equipment manufacturer who has applied himself specifically to these particular problems. And there is also a reciprocal value to the manufacturer not necessarily measured in terms of orders or inquiries, but in a better understanding of the ways in which his equipment or material can be of greater service to industry.

WHEN the Fourteenth National Exposition of the Chemical Industries opens its doors at the Grand Central Palace in New York on Dec. 4 it will have behind it almost twenty years of distinguished service. During that time it has played a prominent part in the solution of many of the problems that have threatened the progress of the American chemical industry and profession. Now, it comes again at a particularly appropriate time. Chemical industry, along with all other, is slowly emerging from the greatest struggle in its history. The need for the physical tools for further progress was never more urgent. Chemical engineers who must carry a heavy burden in advancing the process of industrial recovery will find much of help and encouragement in the exhibits of modern equipment for increasing efficiency and reducing cost. The two and a half years since the last Chemical Exposition have been particularly fruitful from the standpoint of new processes and new designs for improved equipment. The next two years will be even more fruitful for chemical industries if these advances in technology can be promptly and effectively translated into profitable operations in modern plants.



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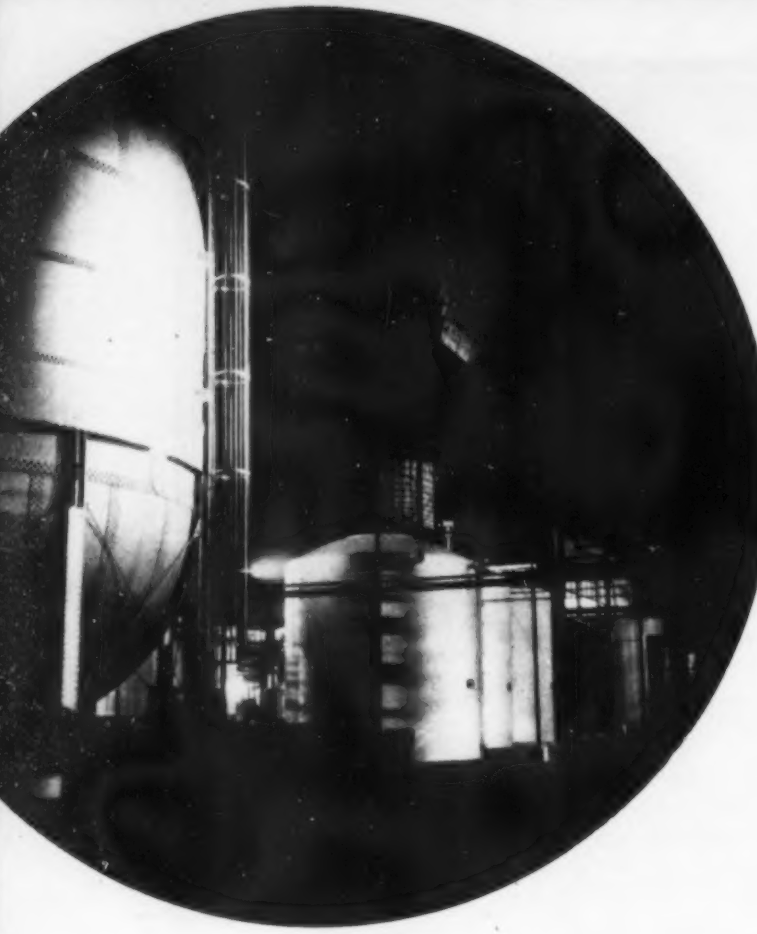
THIS FIRST AWARD for chemical engineering achievement to be given to a company rather than to an individual was planned as a recognition of group effort and attainment. As announced in *Chem. & Met.* in May, 1933, it was to be awarded to the company in the process industries that through the effective use of chemical engineering in any phase of its activity has contributed the most to the industry and profession since January, 1930. Accordingly the "depression achievements" of more than twenty companies were carefully studied by a distinguished Committee of Award and only after the competition had narrowed to three outstanding groups was the highest rating given to the Carbide & Carbon Chemicals Corporation. As its major achievement in the building of a great synthetic aliphatic chemicals industry is described by word and picture in the following pages, the reader is constantly reminded of the purely chemical engineering nature of this enterprise. From the outset it has been planned, operated, and managed by men who in fact if not in name are chemical engineers. It is a worthy example of the best that the profession has contributed to the advance of American industry.

Sidney D. Kirkpatrick, Secretary,
Committee of Award.



CHEMICAL ENGINEERING

BUILDS A

SYNTHETIC

SYNTHETIC aliphatics are now a significant part of American chemical industry. Laboratory curiosities have become tonnage and tank car chemicals. Entirely new products not previously known even to the organic specialist are being synthesized commercially. Natural hydrocarbons are retailored to fit each industry's wants. Compounds of predetermined properties are custom-built to user specifications. All these achievements are properly credited to the past decade of development by Carbide & Carbon Chemicals Corporation. And much of the achievement has culminated during the depression period in new compounds, new uses, and new service to industry.

To have a complete picture of the effort which culminated in 1920 with the organization of the Carbide & Carbon Chemicals Corporation one must go back into pre-war days to the researches of Dr. George O. Curme, Jr. at the Mellon Institute, conducted for and in cooperation with some of the companies which later became units of the Union Carbide and Carbon Corporation.

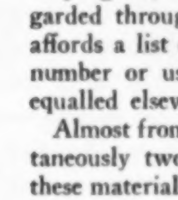
This new subsidiary has in the subsequent twelve years of progress, become widely recognized and favorably regarded throughout American chemical industry. It now affords a list of synthetic aliphatic chemicals unrivaled in number or usefulness and manufactured on a scale unequalled elsewhere in the world.

Almost from the start this company has asked itself simultaneously two questions: (1) What can we make from these materials? (2) What can we sell, if we should make it?

Two separate research organizations have been engaged continuously in the answering of these questions. The one, extending from the fundamental organic chemical research laboratory through the group engaged in equipment design, has investigated the possibilities of manufacturing new derivatives from the hydrocarbon raw materials utilized. The other group, approaching the problem very differently, has consistently tried to determine the needs of user industries measured either in terms of specific chemicals or of new combinations of properties of chemicals. And often the answer to the questions of this latter group has been merely a definition of wanted properties without initial knowledge as to what the composition or structure of the compound might be.

A highly skilled, thoroughly scientific management has consistently blended together the results of the two groups into a practical plant making marketable products with properties desired by the customer. Every officer of the Corporation is himself a technical man, almost all chemical engineers in experience if not originally so trained. An outstanding result of this technical leadership has been the placing of fundamental research in intimate association with the operating plant, *without loss of the research objective.* Thus chemistry was taken to Clendenin, W. Va. in 1920, the point of its application. There research was done along side of engineering development and production. Chemical engineering economics of the plant thus were ever present, a stimulating as well as a guiding influence on the investigators. The result was highly successful chemical engineering of the broadest type, a full justification of the novel management policy.

Design and erection of plants, together with the elimination of initial difficulties and the assuaging of growing pains, have been much easier throughout because of the intimacy of association maintained between research and operating staffs. Oftentimes the chemical engineer responsible for early research results has continued with the processes until they were assured operating successes in the hands of the plant staff. A like independence from conventional thinking has been achieved in the straight engineering work. Here, too, thoroughly grounded chemical engineers have been in charge. They have had available resources of great value in associated companies. It is not strange, therefore, to find construction of all-welded type, as regularly preached by Linde, and a generous use of the most modern types of alloy steels, many of them products



Aliphatic Chemicals Industry

of fundamental research in the affiliated Electro Metallurgical Co. However, at no time has mere promotion of coordinate developments interfered with sane chemical engineering judgment within the Chemicals Corporation.

Oftentimes the developments of the new products have been the result of the desire to utilize existing byproducts of going operations. In other instances the desire for a more complete line of commodities to offer to customers has occasioned the development by new manufacturing methods of compounds already widely available. But rarely has this type of duplication been as significant as was the really creative activity in virgin or relatively new fields.

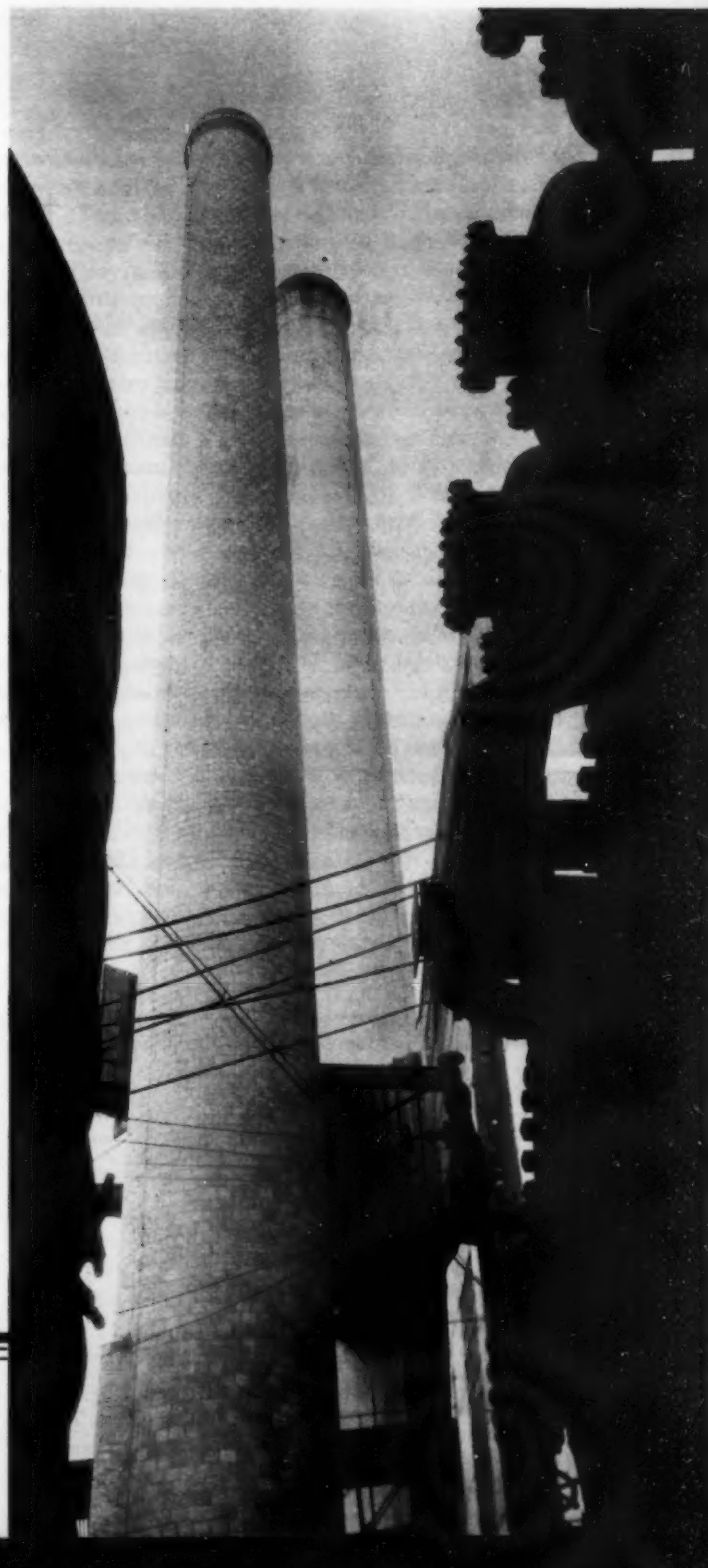
Sales too were placed in the hands of highly trained chemists, men who are far more than salesmen. They are as welcome in their customers' offices as any consultant, for in fact they assume such advisory relationship with respect to the chemical and plant problems in which their new materials may be used. Developing new applications of advantage to the users is regarded as much their job, aided of course by the customers' service research staff, as is the usual selling effort.

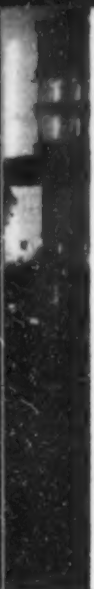
The full story of the decade from 1920 to 1929 is too long to recount here. It suffices at the moment to summarize the major results of that decade of effort. These results can be compactly pictured in a list of the twelve major compounds which were being regularly marketed by 1929. These were:

Ethylene Glycol	Carbitol
Cellosolve	Butyl Carbitol
Cellosolve Acetate	Ethylene Chlorhydrin
Butyl Cellosolve	Ethylene Dichloride
Methyl Cellosolve	Dichlor Ethyl Ether
Diethylene Glycol	Triethanolamine

In contrast with the period four years ago, the Corporation now offers a list of not one dozen, but approximately five dozen distinct chemical compounds. Mere cataloging of them is not interesting. But a consideration of how they have come into being, the service which they render to other industries, and the function which they serve, has wide importance for chemical engineers.

American chemistry has long had available methanol, ethyl alcohol, ethyl ether, and acetone, but none of these products was made in America by synthetic methods until





lately. In some cases the result was not only new supply but also supplies at new lower prices. And in all cases price stability, resulting from the enlarged synthetic supplies, has facilitated building of new markets and expanding old ones in which price variations have been a handicap.

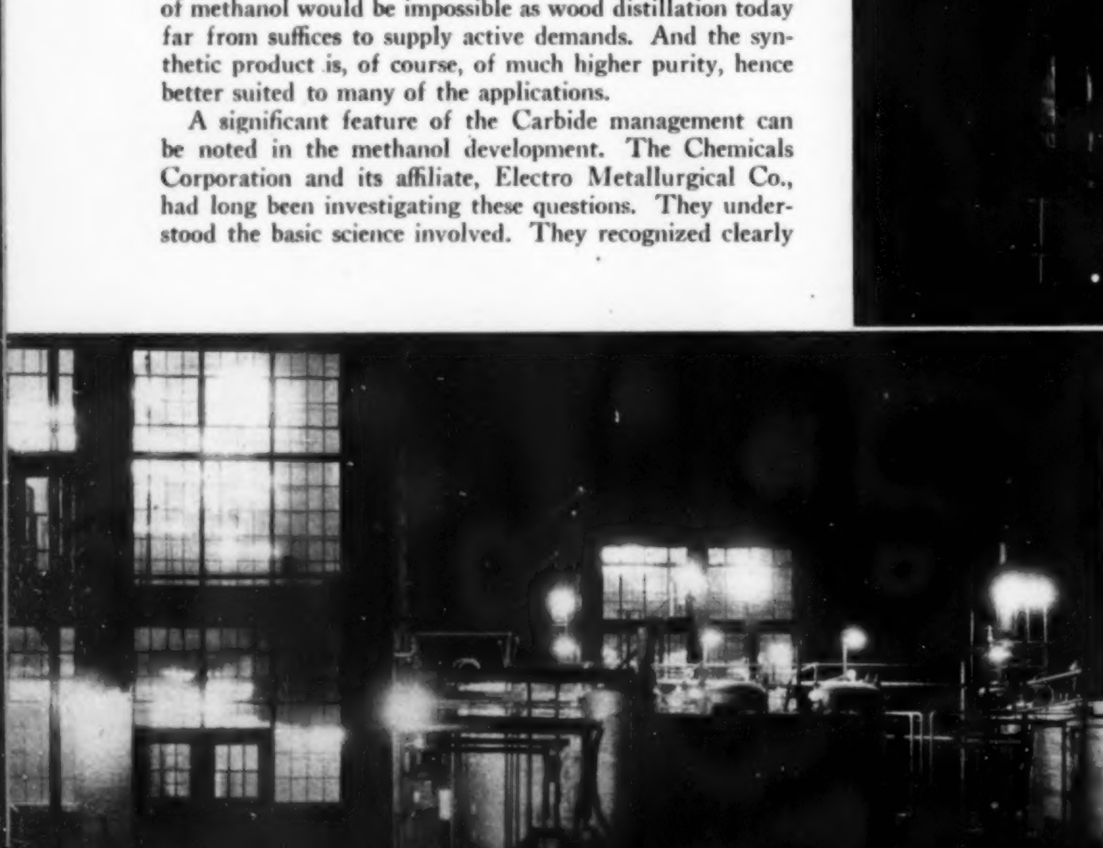
With respect to three of the four compounds, that is all except methanol, the Carbide organization pioneered. And the methods which that group has used for methanol are quite distinct because of the novelty of the raw materials employed. A major motive in developing each of these four compounds by the company was to provide a complete line of organic solvents of the aliphatic series, thus ensuring the opportunity to render a full service to customer industries. But other motives were often even more compelling.

Acetone, for many years a product of destructive distillation of calcium acetate, is utilized on a large scale as an absorbent for acetylene by another Carbide subsidiary. From time to time the high price or short supply of acetate from wood distillation occasioned large and sudden changes in the market price of acetone. Fermentation supplies were offered with like irregularity. The result was a burden on the purchaser too great to go unnoticed. The question was obvious—"Cannot acetone be synthesized from some of the available hydrocarbon raw materials so that we may be at least assured of a stable price perhaps even a materially lower price than the average of the past?" The Chemicals Corporation set out to answer this two-part question; and the answer to each part was "Yes".

Synthesis of methanol from carbon monoxide and hydrogen was not first done even in America by the Carbide organization. But that group was the first to utilize as its raw material a byproduct furnace gas, essentially pure carbon monoxide from the furnaces of an affiliated company. Part of this carbon monoxide by catalyzed reaction with steam furnished hydrogen for the mixture to be synthesized. The byproduct carbon dioxide became a major source of dry ice for the solid carbon dioxide industry. The synthetic methanol, with that made by contemporaries using somewhat similar processes, now dominates the American market, supplying at times over 80 per cent of the total requirement for reagent, solvent, anti-freeze, and other industrial uses. Without it much of the present use of methanol would be impossible as wood distillation today far from suffices to supply active demands. And the synthetic product is, of course, of much higher purity, hence better suited to many of the applications.

A significant feature of the Carbide management can be noted in the methanol development. The Chemicals Corporation and its affiliate, Electro Metallurgical Co., had long been investigating these questions. They understood the basic science involved. They recognized clearly the outstanding difficulties. They believed that the job could be done. An abrupt change in business conditions occurred affecting the future of this project. It was necessary to jump almost without notice from small-scale experimentation and drafting room plans immediately into plant construction. Confident of the well-balanced ability of its design and operating groups, the management appropriated the needed funds, authorized the immediate beginning of construction, and told their sales force to get busy and create a customer clientele. Few process industry managements have ever dared more in a single sudden decision and few such decisions have proved as well justified.

There are operating today in the world perhaps only two plants making ethyl alcohol by direct synthetic methods. One of these is a tiny plant operating in northern France. The other is the Carbide & Carbon Chemicals plant at South Charleston, capable of making as it stands perhaps 10 per cent of the country's requirements of ethyl alcohol. It produces this product by a process never before used on a commercial scale in the United States. The product is of outstanding purity, and reputed to be of rela-



Chemical engineering carries on!

Night and day operation essential in modern chemicals production.

Island of Light in the Great Kanawha at South Charleston, West Virginia.

tively low cost even when compared with fermentation alcohol made from cheap molasses.

The manufacture of synthetic ethyl alcohol was a logical part of the South Charleston development as a means for full utilization of the large quantities of ethylene which could be made at relatively low cost in the processes of hydrocarbon cracking practiced there. Thus the making of the alcohol was almost equally inspired by the desire for a supply to be used by the company itself, a desire for a full line of solvents to offer the customer, and a desire for completely balanced utilization of hydrocarbons being made as the basic starting material for the entire South Charleston chemical enterprise.

Ethyl ether is made by this Corporation inevitably at one stage of its chemical processing. What is more logical than that ether once available should be sold, rather than all re-processed into other chemicals? Furthermore, what is more logical than to have ether as one of the solvents offered to the customer along with the other widely used aliphatic solvents of wide-spread every day demand? And this ethyl ether is today available at a new stabilized low price, independent of ethyl alcohol prices, and guaranteed consistently of extremely high purity. This availability even in tank-car lots of USP specification quality gave prospective users an assurance that large-scale extraction and processing systems needing ether could be undertaken without risk of interrupted supply.

The solvent user, especially in the fields of colors, plastics, and lacquers, recognizes fine distinctions between closely related products. He must have accurately controllable properties in his solvents, his thinners, his plasticizers, and in the other constituents of closely controlled complicated operation. Even such remote considerations as the atmospheric humidity at the time of use of the lacquers must be considered in the selection of some of the constituents. And scores of other like precautions impose heavy burdens on technical managements engaged in these types of manufacture and marketing. To these groups of users the availability of a multitude of new organic compounds, varying step by step from the simpler to the more complex, was a Godsend. It became possible to prescribe wanted combinations of boiling range, dry point, odor, specific gravity, fluidity, and other physical characteristics.

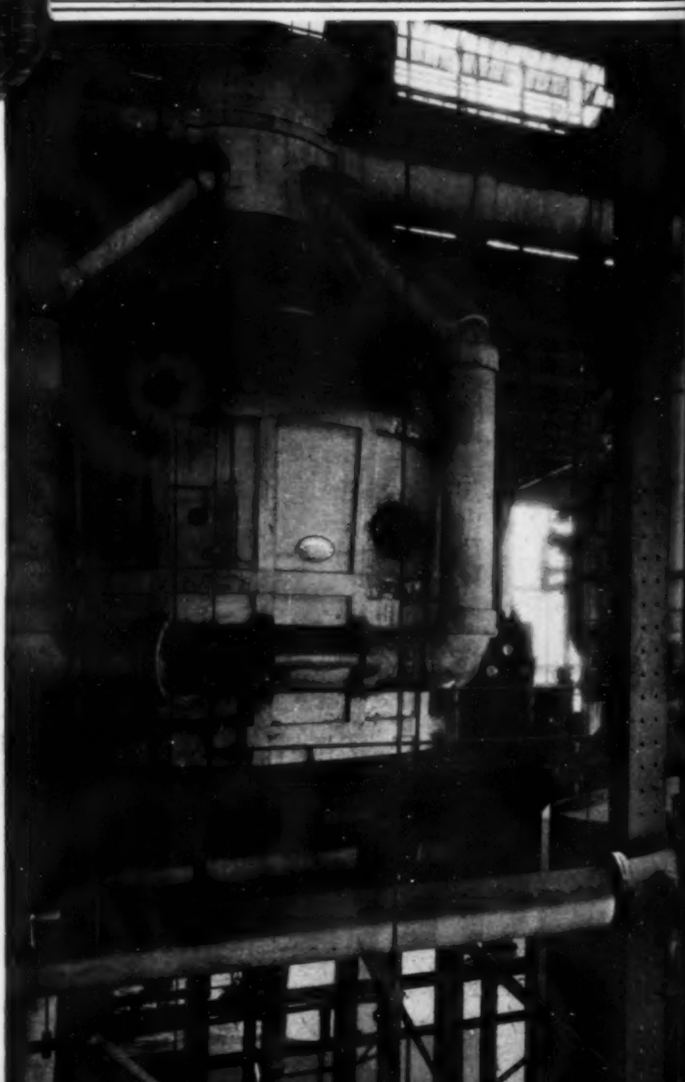
Let the would-be customer draw such a specification merely as to wanted properties and it became the job of the customers' service laboratory to meet them. This meant that the methyl, ethyl, propyl, butyl, and higher saturated alkyl esters were all in demand. Not only acetates and butyrates were available; higher acid esters also could be used. There were also more complex types to be considered, the chlorhydrins and the olefine oxides.

The customer was not compelled to look in an elaborate catalog in the hope that he might find there the desired combination of properties. Instead he wrote them in a

letter saying, "Please send me a can of something that will behave thus." Not always by return mail, but most often quite promptly, it would come back not merely a chemical description of the wanted compound, but also a sample for test to determine the usefulness. A significant part of the whole nitrocellulose-plastic industry was based on the availability of compounds of these manifold types. And several other less obviously chemical enterprises depend on the several new series of aliphatics.

With the availability of each new compound there, of course, came the question "How much can we sell? And where?" A study of this problem also was a job for the customers' research group aided by the central sales management. And throughout the entire staff was the experienced chemist and competent chemical engineer who worked on the problem. No selling merely to make a sale sufficed. The selling had to render a real service on which permanently good trade relations might be built. Naturally there have been relatively few occasions for backing up and reconsidering when this spirit of sincere cooperation has prevailed between producer and user. One such instance seems worthy of note, however, for it emphasizes a matter of public interest.

A number of years ago the research laboratory developed a product that might be substituted for ethyl alcohol in the making of flavors, extracts, essences, and the like. It was christened "Flavorol." It seemed to have all the desirable properties and was an exceedingly good solvent. But marketing was not allowed to begin at once. The management knew this product was to go into many cosmetics, pharmaceuticals, or even foods. Its physiological properties were



CHRONOLOGY OF PROGRESS

In Building a Synthetic Aliphatic Chemicals Industry

1925. Successful commercial production* of Cellosolve (ethylene glycol monoethyl ether), ethane, ethylene, ethylene chlorhydrin (40%), ethylene dichloride, ethylene glycol, isobutane, methane, propane, Pyrofax.

1927. Cellosolve acetate first announced.

1928. Butane, Carbitol (diethylene glycol monoethyl ether), butyl Carbitol (diethylene glycol monobutyl ether), butyl Cellosolve (ethylene glycol monobutyl ether), diethylene glycol, triethanolamine.

1929. Acetone, butylene, carbon dioxide, dichlorethyl ether, dioxan, ethylene oxide, isopropanol, methyl Cellosolve, propylene, vinyl chloride.

1930. Carboxide, ethyl alcohol, ethyl ether, isopropyl ether, methyl alcohol, Vinylite resins.

1931. Butyl acetate, butyl alcohol, butyraldehyde, propylene chlorhydrin, propylene dichloride, propylene glycol, propylene oxide.

1932. Acetoacetanilid, diethyl sulphate, diethanolamine, monoethanolamine, ethyl acetate, ethyl acetoacetate, methyl acetate.

1933. Acetic anhydride, butyric acid, dipropyl ketone, ethylene chlorhydrin (anhydrous), isopropyl acetate, methyl amyl alcohol, methyl amyl acetate, methyl isobutyl ketone.

* Precise dates for commercial production cannot always be indicated, as oftentimes development was progressive from the test tube, through large glass apparatus, to semi-works scale, to drum lots or tank car by gradual steps. The dates given above, therefore, indicate only the approximate time at which commercial culmination of development had been reached with respect to the various chemicals or groups of chemicals.

investigated by the Corporation with the use of thoroughly competent toxicologists and physiological chemists engaged specifically for this purpose. The result must have been something of a shock to the management. The product was so good a solvent that it dissolved material from the stomach and intestinal linings undesirably. No attempt was ever made to market the product for these uses. There was no hubbub of official control.

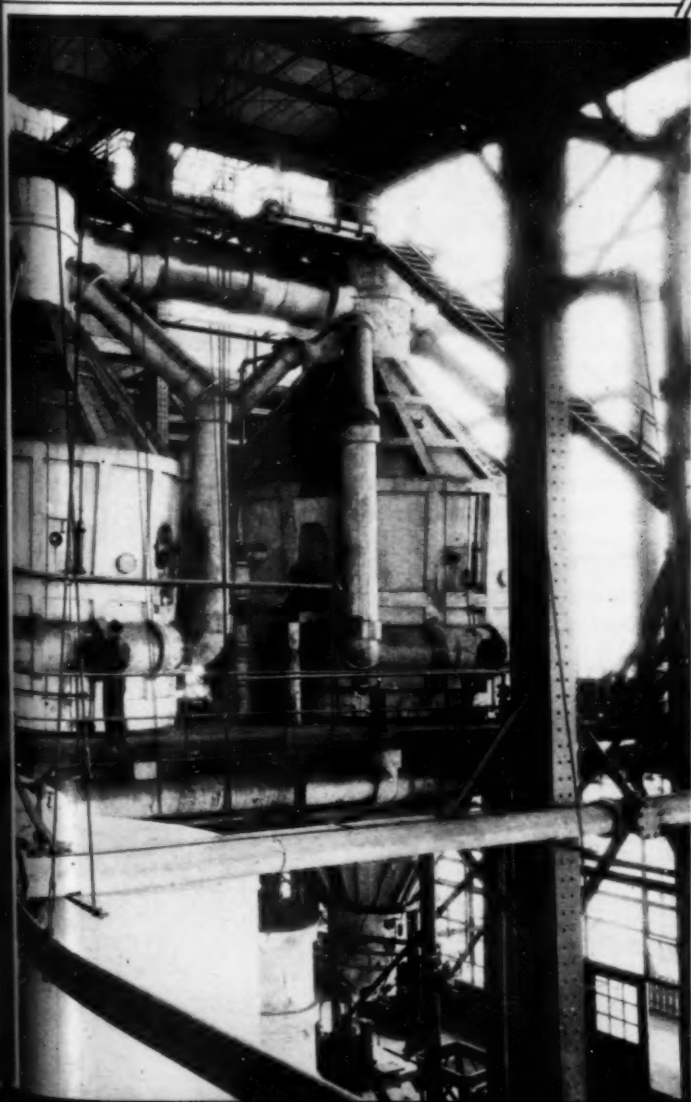
"Flavorol" seemed doomed to suffer untimely demise. But a compound of these valuable properties certainly ought to be useful, so the research executives reasoned. They tried it out in new fields, where internal consumption is not contemplated and the degree of toxicity noted is no greater than that of other accepted chemicals. It became necessary to re-christen the child of the laboratories. And under its new name, it is today widely known as "Cellosolve." It is the most potent and widely used of the cellulose nitrate solvents, a necessity for modern plastic making in many of its subdivisions. Research, seemingly unsuccessful, by more research has become a tremendous success.

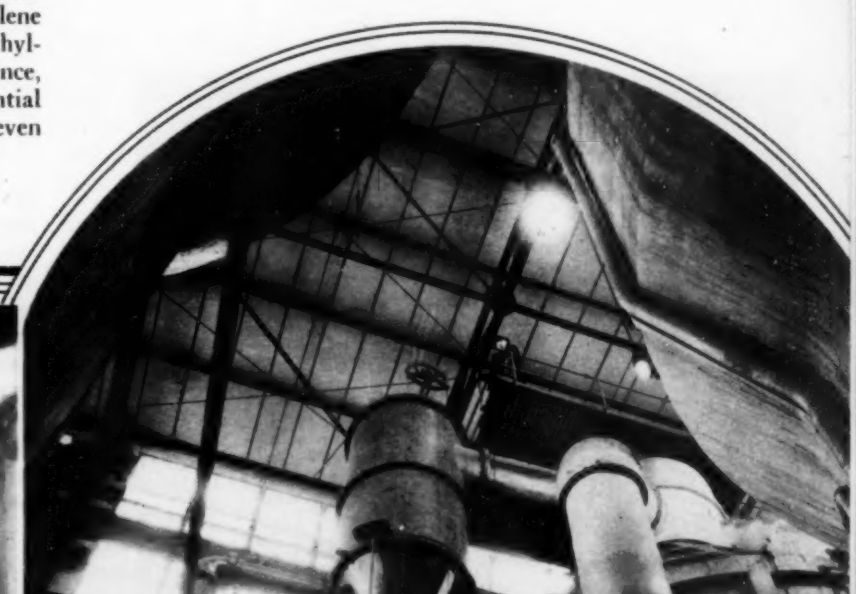
In a number of cases quite novel applications of new synthetics have been suggested. It was discovered, for example, that the dormant period of bulbs and seeds could be materially changed and the rate of sprouting controlled by the use of certain of the new derivatives. Ethylene chlorhydrin, ethyl dichloride, and a number of other ethylene derivatives were shown to have significant influence, indicating a new type of biochemical control of potential importance to the commercial greenhouse, perhaps even to the farmer.

Industrial applications of importance included the making of nitroglycols for dynamites which retained their sensitivity at temperatures much lower than are safe for use with glycerine dynamites. A large new area of effective and safe use was therefore opened. For permissible explosives to be used in coal mining, other Carbide products have proved their worth. Electrical condenser manufacture now frequently depends upon glycol pastes made from ethylene glycol for results not hitherto obtainable. And the justly famous Ethyl gasoline depends as much on ethylene dichloride for producing the anti-knock fluid as it does on the bromide, although the latter has usually been the chemical in the spotlight.

For selective solvent treatment of lubricating oils, dichlorethyl ether, under the trade name Chlorex, has enabled the making of a new sludge-free type of automotive lubricant. This was sold first as "Isovis-D", a product of Standard Oil Co. (Indiana). In numerous other fields the selective solvent properties have contributed materially to new or improved product development.

Industrial fumigation has become an increasingly important art as food manufacture has passed from a simple kitchen industry to the large-scale plant. Ethylene oxide,





Evaporation. Chemical engineering unit operation common to so many chemical processes.

used alone in a concentration of about one pound per thousand cu.ft. of storage space, will at ordinary temperatures destroy such insects as weevils, beetles, moths, even including the housewife's perennial enemy, the clothes moth.

Not a few industrial developments have become possible with the present supplies of pure hydrocarbons available from the Carbide organization. One may now secure from that group methane, ethane, propane, butane, and many of the higher derivatives in almost 100 per cent purity. An equally interesting group is provided in the supply of ethylene, propylene, and their longer-chained unsaturated relatives. Industrially the greatest of these developments so far has been Pyrofax. This was a pioneer bottled hydrocarbon among the liquefiable hydrocarbon fuel gases for household use beyond the city gas mains. Here a large measure of the success has come from the Corporation's long experience and chemical engineering skill in the handling of liquefiable gases during storage, transportation and use.

Very recent developments of this organization have been no less interesting and are no less promising than their predecessors. Butyl alcohol and butyl acetate, among the outstanding contributions of 1932, now find a close relative, butyric acid, in the commercial family. Because of its commercial availability in a pure form, two possibilities are suggested, of cellulose butyrate for plastic use and of ethyl butyrate as a flavor. In this field, of course, these butyl derivatives supplement, and in some cases supplant, because of high purity, like chemicals previously made by fermentation.

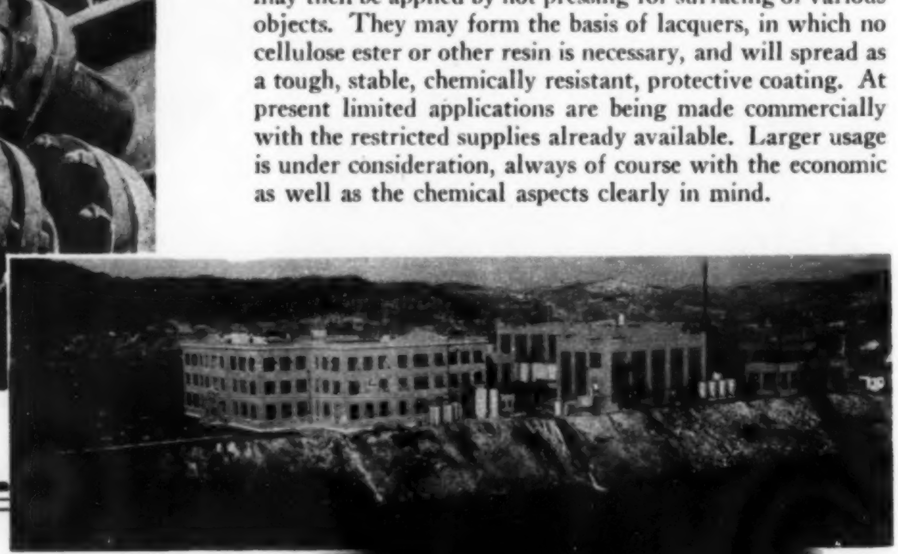
The desire for other ketone-type solvents has been recognized for sometime. Very recently there have been announced Hexone, methyl isobutyl ketone, and butyrone, dipropyl ketone. These are two of the new group of medium-boiling solvents made available in tank-car quantities. Hexone is a good solvent for gums and resins and has high blush resistance. Because of this solvent power, its dilution ratio appears distinctly higher than earlier compounds, making possible lacquers of higher nitrocellulose content without increasing viscosity.

A like development has gone on in the field of alcohols and aldehydes, derivatives of multi-carbon hydrocarbons. New octyl compounds are soon to be offered. These derivatives will be 2ethyl-hexanol and the corresponding 2ethyl-hexanal. If there be need for the like derivatives of the other higher hydrocarbons, either of the saturated or unsaturated series, seemingly they can be made on demand.

Possibly the newest spectacular development of this group has been in the field of the Vinylite resins. As an evidence of the real commercial possibility in this direction, visitors at A Century of Progress in Chicago saw an entire bungalow with floors, wall finish, even the complete trim and doors, made of this interesting new plastic resin. Admittedly, not all of these products are fully commercialized as yet. But it is evident that they can be so made.

The resins, which result from polymerization of vinyl compounds, have been known for many years. But commercial development has awaited production of resins with the appropriate physical properties. When pure these resins are colorless, odorless, tasteless, transparent, and non-flammable thermoplastics; but they may be colored with dyes or pigments and given any degree of opacity by incorporation of fillers. Modified with appropriate plasticizers, they can be molded, sheeted, extruded, and otherwise shaped at will. They are highly resistant chemically to all acids, except glacial acetic and phenol, and to all alkalis. They are, of course, susceptible to thermal attack, as they retain their thermoplastic property after forming.

A wide variety of applications has already been demonstrated. Some of them are suitable for dentures; others have been used for large cast pieces weighing as much as 150 lb. and as large as $2\frac{1}{2}$ by 8 ft. in surface area. The resins dissolved in ketonic solvents are used to impregnate porous media, such as paper or textiles, which after drying may then be applied by hot pressing for surfacing of various objects. They may form the basis of lacquers, in which no cellulose ester or other resin is necessary, and will spread as a tough, stable, chemically resistant, protective coating. At present limited applications are being made commercially with the restricted supplies already available. Larger usage is under consideration, always of course with the economic as well as the chemical aspects clearly in mind.



Carbide's new research and developmental laboratories.

An EDITORIAL

The Case for MODERNIZATION

IN THE MIDST of the frenzied economics of 1933, the work of generations is being compressed into a few short months in an attempt to set aright the ills that afflict society. With many of the recognized principles failing us, today's demand is for experiment and for side trips along unfamiliar paths. It is hardly surprising, therefore, that the obvious—though fallacious—solution for the problem of putting people back to work should be to declare a holiday on mechanization. If machines create unemployment ban them, or at least carry their efficiency no farther: so the refrain goes.

Even certain officials of NRA fell into the pit of standstillism in the earlier days of the New Deal, but, fortunately, this sort of thinking is no longer in favor in Washington. In fact, the Recovery Administration is now marshalling its forces for a drive to accelerate the purchase of so-called durable or capital goods. Pointing out that this has been a capital-goods depression; that employment in these industries fell some 59 per cent from 1929 to 1932 and wages, 72 per cent; and that for every capital-goods worker returned to the payroll, three workers in other industries can be reemployed, the NRA is now putting the rehabilitation of the capital-goods industries up to the nation as a patriotic duty.

BUT there is more than patriotism involved in the modernization which is the other side of the capital-goods rehabilitation picture. There is increased return for the users of capital goods. There is life for the construction industries and for the builders of the tools of production. On the one hand revived activity in this field will mean that the wages earned by capital-goods employees will return to the avenues of consumption through purchase of consumer goods. On the other hand it will mean that producers whose costs have been increased by the codes can recover a part, perhaps all of the increase, through greater production efficiency. If there is any one means of putting the system into balance again, that means is surely the one of re-employing those people who now must depend for subsistence on the donations—direct or through taxes—of others. As long as incomes must so largely be shared without equivalent production, there is not the faintest hope of adjustment to normal conditions.

NEVERTHELESS, under the New Deal, it is generally supposed to be anathema to talk of labor saving. Increased efficiency is all very well, but "labor saving," no. This inconsistency, of course, has no economic justification, but it has plenty of adherents. There have been code-makers, for example, who attempted to write standstill agreements into their rules of fair play, banning the installation of new machinery; not alone new capacity, but also replacements. The theory was not so much that employment would be created thereby, but that capital would be saved. What these code-makers forgot was that it is not savings but money in circulation that creates sales; and that the perpetuation of high cost in one industry means increased competition from another and a lowering of living standards and of purchasing power that can by no means benefit the laggards.

From the viewpoint of a single industry, then, failure to modernize means the standardization of high cost and low consumption. From the standpoint of society the result is identical, but being all inclusive is even more disastrous. Granting that the immediate effect of modernization in an industry may be some temporary decrease in employment in that industry, it is nevertheless true that in the past the ultimate effect has generally been the reverse; for with decreasing prices, an increasing demand has been found to exist for most commodities. Consumption is inherent in production, as effect and cause; for it creates its own purchasing power.

Furthermore, except in the case of certain commodities, such as food, the theory of limited demand becomes untenable to anyone who will stop to consider whether

two pairs of shoes or one overcoat constitutes the limit of his personal capacity to consume.

Thus it is evident that the preservation of inefficiency benefits nobody: certainly not society, for it has fewer goods for its use than it might have. Certainly not industry, for in making fewer goods than it might, it can retain the value equivalent of fewer as its profit. Certainly not the consumer, for he loses both coming and going: on the one hand as a producer, on the other as a member of society.

Without attempting to belabor the issue, we are perhaps justified in one further demonstration of this all-important principle of the need for continuous modernization. In the maze of money, credit, debt, exchange, gold standards and what-not, with which we have cluttered our fundamental aims, it is easy to lose sight of the basic simplicity of human activities. At bottom, we are concerned with but two economic pursuits: the production and consumption of goods and of services. The latter are clearly subsidiary, to be paid for in large part by the former, for production supplies subsistence.

It follows, then, that prosperity consists in the production and consumption of relatively large quantities of goods and services and that higher standards of living hinge on the ability so to produce and consume, with ample leisure for the latter process. As a second corollary, it is apparent that a prerequisite to prosperity is increased production efficiency, whereby manufacture becomes so productive that fewer producers are needed and more goods are available for the payment of services. More goods, more services, shorter working hours, more leisure: these are the ingredients from which higher standards are compounded. The process is capable of almost endless expansion, limited only by the economic rate at which irreplaceable raw materials should be consumed.

But to come back to earth from cosmic generalities, let us forestall a hoary argument that is often advanced by the *"status quotians."* It is admitted here and now that the modernization of all units in any branch of industry would be of direct benefit to none of the participants except in so far as the benefits were reflected back from society in larger consumption. It is granted that competitive advantages would be lost and that some uneconomic replacement would doubtless take place. But such a situation is not a factor in actuality: it is too much to hope that there would be no laggards. Certain units, in the scheme of things, are bound to be progressive, others not. The economist's "marginal" producer is always with us and it is because of him that larger than average rewards are waiting for those who are far-sighted enough to see wherein their interest lies.

AND there are other concrete phrases in this business of getting ready for the recovery. One is the fact that price, as the criterion of competition, has been de-emphasized. Quality, as the chief remaining variable, has come to the fore. Quality means higher efficiency in plant and equipment, improvement in the methods of management and in personnel. How are we going to go after these things in the face of depression-scarred exchequers? How shall we know when and where modernization is justified? How improve plant, power services, instruments, equipment, distribution and factual tools? The program is enormous, the pages that follow merely a start, but if they accomplish one thing, they will have served their purpose: to drive home the single outstanding fact in industrial recovery, that modernization and modernization alone can answer the demands for lower costs and higher quality that exist today after four lean years of famine.

WHAT ABOUT THIS PROCESS?

Never has there been a time when more depended on the continuing advance of chemical engineering technology! New processes, new products, new markets are the order of the day. There isn't a place in your plant that you can afford to overlook in your modernization program.

By L. C. MORROW
Editor, Factory Management and Maintenance

MANAGEMENT Now Faces New Responsibilities

RECOVERY means that people are going to work again. But they are not just picking up where they left off, each person in his old job, and they are going to work under quite different conditions. So management has new problems to solve in preparing, organizing, and directing the efforts of these people.

Employee training is a problem. People must know how to work efficiently to earn their higher pay. Usually it is best that they be taught. Few people are good teachers; those few must be selected from the foundation personnel by management.

Knowing how to work efficiently, the employee must be directed in the application of his knowledge. There must be someone to supervise him—supervisor, foreman, gang boss, straw boss, leader. In itself, the selection of the forces of supervision, the minor executives, is a job for management. The number of people included in this category is growing. Four 6-hour shifts require more minor executives than do three 8-hour, or two 12-hour shifts. It is usual practice to promote from the ranks—a tremendous good-will builder.

From the moment he rings in on the first day the employee must be paid. First, the learning wage; how long shall the training period be? Then the minimum wage; that, of course, is fixed. But if he is to advance to a job of skill? And when he does, how much to pay him? What to pay the man of experience who comes in as a skilled worker? What differentials to maintain? How regulate incentive, bonus, and piece rates in the interest of labor costs consistent with competitive position in selling the product? Paying the worker is, indeed, one of management's problems.

Of course the work must be done in safety. Green hands are big risks. So are people who have not worked for a long time, even though they have been well fed. But if undernourished or in poor health, they are a still bigger risk. Accidents, illness, absenteeism are costly; their prevention is a problem of management.

Attitude cuts much ice. A man may resent a machine all the time he operates it, thinking about how many more men would be working if it weren't in existence. Silly to think that way; maybe some well-directed educational work would set him straight. Management's problem to show him it's the machine that pays the wage.

A part of the educational program should be a definite attempt to show the worker that successful selling begins in the plant—with him. Many times he can put in or leave out quality; he can run up unnecessary labor cost, waste material, depreciate equipment; fail to contribute his share toward short-cuts in manufacture.

Likewise he may be caused to understand that his real competition exists—not in the management of his plant, or in his fellow workers—but in workers like himself in competitive plants. If those other workmen do put in the quality, do keep the costs down, their plant is in a better competitive position, has a better chance of maintaining jobs. In short, any worker giving less than his best to his employer is playing into the hands of his employer's competitor.

The amount of work that an employee can do in a given unit of time depends partly upon his own efforts, but also partly upon the tools provided for him and the positioning of those tools. Ordinarily the boss can see that his men keep up to speed, and that they exert the correct amount of physical strength. But, unless specially trained, the bosses are not likely to know all that can be done to eliminate lost motion. Management can train the boss by supplying such tools as time-and-motion study and process charts. Their proper use will let neither the worker nor the product indulge in too much lost motion or aimless wandering.

Foremen themselves are a problem. They are close to the workers, are the most direct influence in bringing about the new executive control required by the "New Deal." They know what the top executives have to know—that is, what's on the worker's mind. As an individual the worker thinks along certain lines. If he becomes a union man, his thinking is likely to

change; it takes on the characteristics of the collective mind. To deal with that offers problems all its own. Foremen must not be "forgotten men" as to either training or salary.

When management knows what's on the worker's mind, it knows whether or not he is satisfied as to hours, place of work, heat, light, food, red tape, pay; how he feels about unions, piece rates, bonus. If it is important for management to know all that, it is also important that the worker know what's on management's mind. What is management's attitude toward labor? Is it running the business so that the worker is reasonably sure of his job? Is it keeping abreast of competition? In short, is it fair and efficient? The Works Council has been known to disseminate this information satisfactorily; so have company publications, or house organs; so have mass meetings, at which the top executive or some representative lays the cards on the table.

How much pay he can get is always on the worker's mind, which means that the same subject must be on management's mind. Minimum rates of pay cannot be maximum rates. There always have been differentials in pay in proportion to skill required. The closer we come to eliminating these differentials, the more disgruntled the skilled worker becomes. There already is dissatisfaction in some instances where the skilled man has had a raise of only 5 or 10 per cent against the unskilled raise of 20 or so.

Unskilled labor in itself offers difficulties. Minimum rates may vary in the same town, even in the same plant for the unskilled laborer employed in different industries. This condition probably will result in a settling down so that the least worthy, or the least fortunate will gravitate to the ranks with lowest pay. But, if there is anything like a shortage of unskilled labor in a community it will tend to fix the highest rate in that community as the one rate. In the same way, if two rates of pay are authorized in the same plant, the same tendencies will prevail.

WHEN incentive systems are used (usually in connection with skilled or semi-skilled labor), good management will be careful. If operators are given tasks on which the rates are too low, they will simply take things easy and accept minimum wage allowances. If rates are set too high, the company pays unearned bonuses, which is bad for net profit.

In all of the problems mentioned labor plays a part. They are the most pressing, are intensified by the new provisions under which industry must operate today. There are other problems in which labor has no part. Cost control is one of them. Codes tend to make statistics obligatory. If a plant becomes the subject of complaint within its own industry, the burden of proof will be its own responsibility. It is reported that manufacturers upon whom fines have been imposed for lack of code conformity have learned that oral statements, unsupported by clear records, do not go. Because most codes declare against selling below cost, records of cost, and therefore cost control, are vital. Of course the control of cost, and the cost recording system that must be a part of it, always have been indispensable to the plant that knows where it is going; it just happens that some of them failed to believe it was so, got along somehow, often by plain luck.

Another of management's problems is the cost of power. As other costs tend to become fixed, the importance of any revisable costs increases. And the cost of power is revisable downward in many instances, both in generation and transmission. In most plants the cost of buying or making power and applying it needs investigation. Whether power is generated or purchased, the unit cost is not necessarily fixed. Many plants operating obsolete or inefficient generating equipment have found that costs could be lowered considerably by buying their power. Others have found that they could save money by generating their own.

COMPARATIVELY few plant men realize how much can sometimes be saved by study of the contract with the power company to determine, first, whether it is the most advantageous form of contract to which they are entitled and, second, how they can best meet or take advantage of its provisions.

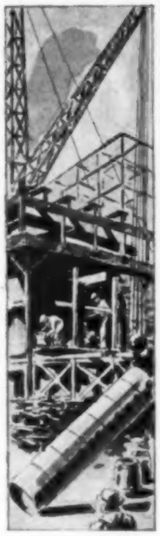
There still remains the important problem of utilizing electrical energy to turn the shafts of production machines. At every step in the process there are many opportunities for loss and inefficient use of power. Some of the losses are electrical, as in transformers, distribution lines, and motors; others are mechanical, in bearings and transmission devices. Together they often account for a surprising proportion of the total power paid for.

In conclusion, something about equipment. Much merit has been claimed for a policy of foregoing the installation, for a time at any rate, of labor-saving equipment. In my opinion, such a policy will not hold water. If we are to halt our process of transferring burdens from the backs of men to machines, we are inconsistent if we do not go farther, replace our most productive equipment by the least productive we can find, transport our materials by wheelbarrow, or by roller and pinchbar, write our letters longhand.

No, there can be no question of stopping growth. Any development, any application that increases the product of an hour of labor is socially desirable. The problem is the control of growth, not its stoppage. It is a question that management will some day solve. Simply expressed, it means that our social system must eventually provide some means of seeing the displaced worker through his period of transition to other work. It is a part of the big problem of "security," about which there is even now very definite concern.

In the meantime organized labor is lending its aid to labor-saving equipment, first by aggressively attempting to expand the domain of organized labor, and second by seeking the 30-hr. week. Whenever the 30-hr. week becomes common practice, there will exist a boom time for engineers, inventors, and research men. In the past, the shutting off of immigration, and the reduction of man power by transfer from industry to army, brought about increased demands for labor-saving equipment, cost-cutting and short-cutting methods.

The same thing will happen again, whatever the cause of a shortage of labor. The lid will be taken off technological development, and management will no longer have inhibitions.



By H. K. FERGUSON

The H. K. Ferguson Co., Cleveland, Ohio

Is YOUR PLANT Ready for RECOVERY?

MOST OF US know that when our plants are busy we are good housekeepers. Many of us have found to our surprise that since we have been idle it has been difficult to get things done. Now we are confronted with a rapidly changing set of conditions which warrant serious thought on the part of all of us, including the very important one of whether or not our plant is ready for recovery.

We must grant that labor rates are being fixed by codes, either now in effect, or to become effective soon. We must concede that the whole purpose of the general scheme of things will be defeated unless definite prices in each industry are more or less established, and previous disastrous price cutting eliminated. There is also a strong tendency to determine a maximum volume of output for each existing plant, with specific limitations on plant additions which would increase present capacities.

Removing these possible variables from our thinking for the moment we find that the possible improvements looking toward lower cost and higher profit from the products of existing chemical factories have limited themselves pretty much to the following:

(a) Lower cost for raw materials, which cost is in itself more or less determined by code requirements for labor rates and transportation charges.

(b) Improved processes worked out through research and made effective through improved and more efficient manufacturing equipment.

(c) More careful management in bringing about reductions in overhead, and in establishing proper supervision in all departments.

In effect, you will see from this that the probable principal improvements in practices during the next few years will very likely be accomplished through the development of new and better plant equipment and arrangement of that equipment.

Too, the entry of truck and waterway transportation is revising the map of manufacturing and distribution for many corporations these days, particularly when the customers' convenience and the reduction of customers' inventories by protecting them from manufacturers' central stock have to be given such serious consideration.

One of the important things which manufacturers are considering today is the question of whether it is not now better to take the factory to the raw materials rather than to bring the raw materials to the factory. A number of manufacturers in the industries grouped under the head of chemical and allied plants, have found that it is much easier and less expensive to ship finished products than it is the raw materials, even at the existing freight rates, which are ordinarily much lower on raw materials than on the finished goods. As I write, I have in mind one plant—that of the Southern Alkali Corp.—which is now under construction at Corpus Christi, Texas—where the owners have found that because of the extraordinary low cost of fuel and raw materials, it has been possible to locate on tidewater at some considerable distance from larger markets, and still deliver the finished products to either seaboard as well as to foreign ports at considerably lower cost than at present.

This plant is being located on an extension of the ship channel of the port of Corpus Christi and will be provided with its own turning basin 800 ft. wide, 1,700 ft. long, with a 30 ft. depth of water, and will serve a 100 by 450 ft. pier capable of handling two ocean-going vessels at a time. Adequate storage space will be provided on the pier for the finished product with a dock house handling in excess of a shipload. A single portal Gantry crane will permit direct loading from freight cars into vessels.

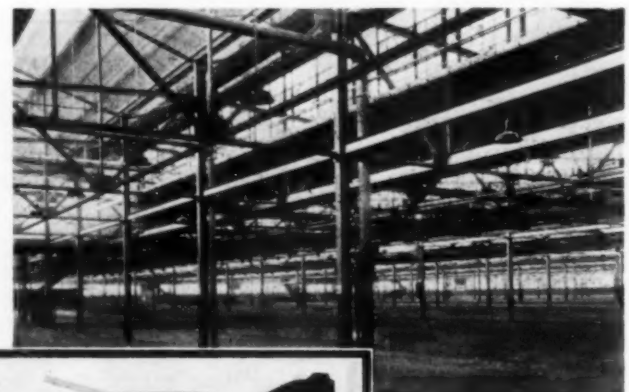
Adjoining the water is a site of some 300 acres of gently sloping ground underlaid with good clay and sand strata for building foundations. Raw materials consist of salt, coke, limestone and oyster shells. Salt will come from the company's own wells on the salt dome in

Duval County where there is available a practically unlimited high-grade supply. Excellent water wells are present in the sand strata above the salt and will supply water for the manufacture of brine to be transported 61 mi. to the plant site through a 14 in. mechanical joint, cast iron line. Owing to the plant location at tidewater, there is sufficient elevation at the salt dome to provide for gravity flow of the brine to a 3,000,000 gal. open reservoir on the plant site. The company owns its own gas wells in a proven field 6 mi. from the plant, and high-pressure natural gas will be carried through an 8 in. welded steel line for boiler and other plant uses. Likewise, fresh water for the two 1,185 hp. Sterling boilers to operate at 450 lb. steam pressure, is to be obtained through a 14 mi. line from the Nueces River at Calallen where a 16 in. cast iron line together with pumping stations are at this very time being constructed.

Southern factories in general have been improving their character and quality and arrangement a great deal of late. An accompanying photograph shows the completely new plant of the Continental Gin Co., at Birmingham, Ala., which has been so designed and constructed as to permit of each building being added to at its rear as the production demands warrant such expansion.

Of course, in the face of present code requirements for labor, it seems likely that the South may lose a lot of the advantage which it has long held because of low labor costs; that with a higher minimum wage rate for labor in the South, and because of the generally acknowledged lower efficiency of Southern labor, as well as the usually higher transportation costs to market for finished goods, it will become increasingly difficult for the Southern manufacturer to produce his goods at a profit. It is probable that the development of such situations may result in later adjustments of labor rates for such areas, but in the meantime some hardship may be expected.

It would hardly be proper to discuss the question of plant rehabilitation without giving some consideration to the two schools of thought with regard to the buildings which house chemical enterprises. Some engineers feel that such buildings should be designed to fit very closely the dimensions of the equipment which is to be placed within the structures. Others seem to feel that room to grow is important, and that because of the constant tendency toward larger clearances and dimensions, that the buildings should be made with sufficient margin over-all to enable various changes of equipment to take place within the limits of the structure without disturbing its main members. Typical of the former is the Albany paper mill of the A. P. W. Paper Co. Of the same general type is the new plant addition built for the Addressograph-Multigraph Corp., at Cleveland,



Unit-by-unit type of plant construction where emphasis is placed on facilitating addition of floor area

Some manufacturers are as much behind times in the use of their plants and equipment in competition with new developments as are these working tools of a Japanese carpenter. (Photograph secured in connection with construction by the Ferguson company of a factory designed and built for Shibaura Engineering Works, Tokyo)

This new plant of the Pepsodent company, with new equipment throughout, has been built to consolidate several plants and take care of possible developments during and following the depression

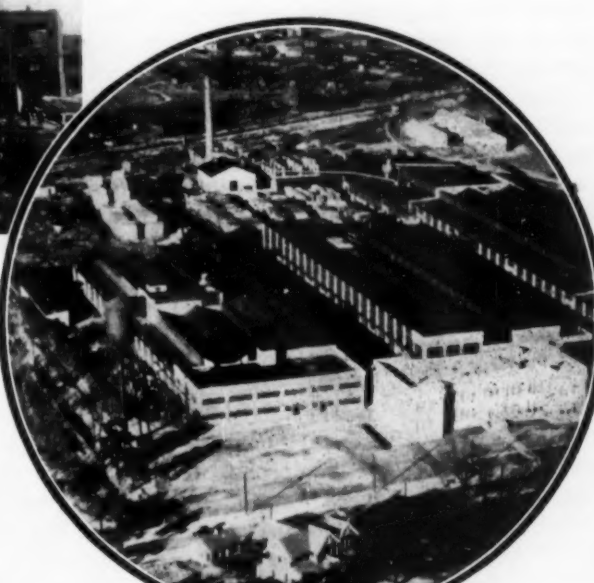
Ohio, which makes use of the so-called standard factory layout of unit floor areas which can be added to, element by element, as the need for more manufacturing space grows.

Personally, I am inclined to hold with the latter school of thought, believing that provision for rooms to expand within the original building not only ordinarily makes for lower cost in construction at the outset, but also affords much greater facility for growth and development during the life of the plant. Typical of this kind of construction is a new plant unit recently completed for the American Enka Corp., at Asheville, N. C., for the manufacture of rayon. It is well lighted throughout the interior, and has been constructed with ample margin for the re-arrangement of equipment within the limits of the original structure.

Along with the research with which all of us are familiar, and which almost from day to day makes market positions insecure, we find that from the manufacturing standpoint the increasing use of higher temperatures and pressures in the generation of power for manufacturing of this sort, is making for lower costs and greater possibilities of volume production, with definitely limited expenditures, and within given limits of time and quality. Because of the tendency toward higher pressures for steam generation with the attendant possibilities of new economies in turbine operation, many process manufacturers are finding that through changes accomplished at moderate cost, they can capture substantial savings in the operating cost of their power plants. In some cases these changes have been successfully financed on a part payment basis out of the savings to be achieved over a period of years.

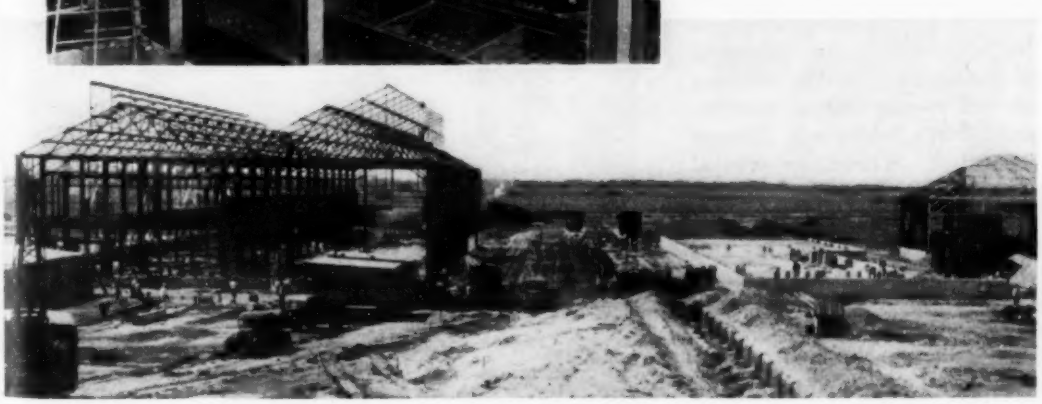
The results have ordinarily been that there has been

Corn Products Refining Co. recently has had built a complete modern plant at Heijo, Korea



Modern construction used where subsequent re-arrangement of equipment is provided for within the limits of the original building

Complete new factory, at Birmingham, Alabama, of the Continental Gin Co.



Construction is progressing apace at Corpus Christi, Texas, on the $7,000,000 new plant of the Southern Alkali Corp.

much less than the normal resumption of employment during the present moderate increase in manufacturing activity, and that most manufacturers have been able to produce rather more than the normal amount of products, and at greatly reduced prices.

This to me indicates that most of us are on the way toward becoming ready for recovery. On the other hand, many of us have found that our plants are not sufficiently flexible as to output, and that one of the things which must be given important consideration in factories of the future is to set them up in units of such size and relationship that they can be reduced easily to one-half or one-fourth capacity and still maintain sufficient margin to pay the creeping overhead, with some small margin of profit.

In several instances lately, manufacturers with whom we are acquainted have found markets for byproducts which had been previously wasted. The sale of these byproducts for manufacturing into marketable materials has been profitable in eliminating red ink, and in at least two of these instances, the manufacturing incidental to this salvaging process has been done on property immediately adjoining the main factories involved.

A number of manufacturers have been unable to go ahead with the rearrangement and reconditioning of their plants for better operation during and after recovery, for the simple reason that they have been fearful of depleting their cash positions before they were certain that the market had turned upward positively enough to assure an inflow of cash sufficient to offset such a depletion. Manufacturers in this position have been called upon to strike a nice balance between the probable increased cost of such improvements on a rising market, and the natural desire to maintain a comfortable surplus of cash in a time when no private or public financing can be done.

It has always seemed a strange thing to me that the financing of industry, the condition of which is really the backbone of our prosperity, is usually the first thing to suffer in a down-hill market, and the last thing to recover when the up-hill trend is resumed. It is likely that out of the efforts of the present administration to restore proper credits, and enable manufacturers to resume production, there may come some arrangement which will offer manufacturers who are holding their plant improvements in abeyance, an opportunity to finance them adequately on reasonable terms, either through their own banks with government support, or possibly directly from the government itself.

No discussion of modern plant location and construction would be complete without giving recognition to the question of the tax burdens which are becoming more and more important each year, as the various municipalities and states, as well as the federal government, decide that they must have additional income from taxes for adequate operation. There are several states already which have increased this burden to such an extent that there has commenced a quiet, but steady egress of industrial operations from these locations into others where the tax burden is less.

Summarizing, then, we are in for recovery whether some of us have become too steeped in gloom to recognize the signs or not. But if we are going to make the most of it, our plant processing and equipment must be ready to step out and keep us up with a place in the procession. It should be apparent now that those who have been holding in abeyance schemes for the improvement of plants and equipment, must make haste to get these sketches from shelves and files, shake off the accumulated dust, revise the estimates, bring the plans and prices up to date, check up possible savings in cost of manufacture and possible reductions in capital cost, still available in the present low market for equipment and building materials, and set certain definite limits on the further postponement of the actual execution of these modernizing projects. As one writer has recently said, we had better make sure of our seat on the band wagon before too many places have been taken.

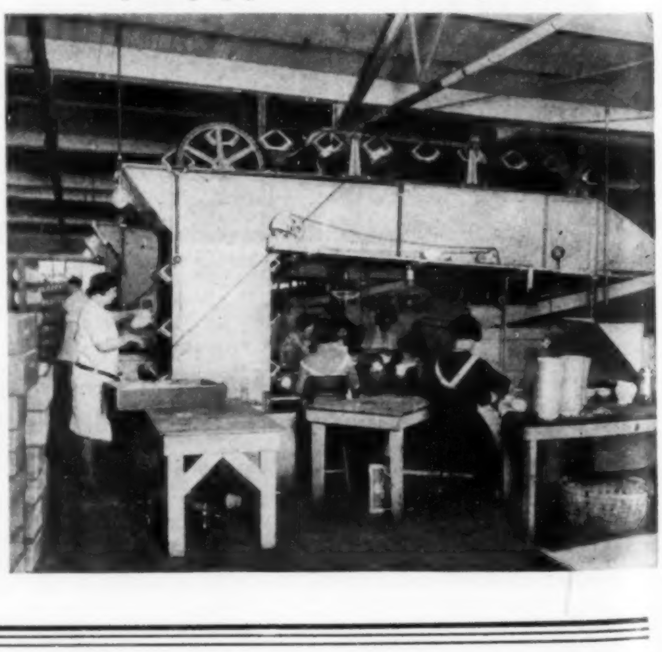
Plant location is important because of labor charges; cost of raw materials delivered at the plant; cost of distribution of the finished product; cost of the tax burden, and the various less important factors which enter into the economic consideration of such matters.

Plant layout is important because, regardless of what type of expansion is contemplated, modern construction practice places a premium upon the provision for ample stock-handling facilities, for the more permanent location of heavier equipment departments, as contrasted to others that can be fairly readily moved about, and for the reduction of plant capacity in line with the recurring ups and downs of the production cycle. A well laid out plant must have "breathing" room.

Plant equipment is important because under code operation it is likely that only by developing it for improved processing, taking into account the possible economies of higher temperatures, pressures, and other variables, can the manufacturer find any large opportunity for securing that differential between established cost and selling price, which means profit for his enterprise.

It is quite likely that opportunities for finding cash for such outlays will presently improve. It is, therefore, important that our planning, budgeting, and scheduling, should be completed quickly so that we can step out on the right foot when the word comes to go.

Mechanical equipment plays important part in speeding up production in modern pottery



By **G. W. ANDERSON**

Chemical Power Plant Superintendent

POWER PLANT LOSSES *Must Be Curbed*

RAPID PROGRESS has been made by the NRA in carrying out the provisions of the National Industrial Recovery Act and the effects are already being felt. Minimum-wage and maximum-hours-of-labor agreements and general furtherance of the share-the-work plan are the order of the day and have been acceded to by many who do not yet definitely see where the extra payroll money is to come from. The plant executive is daily encountering on all sides forces tending to increase his operating costs and render a slimmer profit.

Competitive set-ups have changed. Where formerly the hours of working time and wages paid varied in any one industry, they are now fixed. Raw material prices will gradually become stabilized but at a higher level. Selling costs are approaching a limited percentage, while at the same time price cutting and premiums are discouraged. Larger profits through huge volumes will also be out of the picture. Labor is asking that weekly working hours be still further reduced with attendant payroll increases. Every indication is that the plant owner may find himself caught between the millstones of higher production costs and competitory sales prices. If he sits back and complacently bides his time, hoping that somehow costs will soon decline, a rude awakening is inevitable, for already long term planning is under way at Washington.

The chemical industry has performed wonders in the fields of research and process development in the past decade. However, during the past four years much of the mechanical equipment has been allowed to deteriorate quickly. Much of it is now inoperable because of the robbing of spare parts for active units, made possible by low production rates. As a result of these factors the limit of safe operation has practically been reached. Projected purchases of more efficient money saving machinery have been indefinitely deferred, along with other cost-reducing improvements. This is particularly true in the case of power plant equipment. The Codes were not designed to protect obsolescence. Actually, outmoded and inefficient power producing equipment will now cost the owner more than ever. It is altogether obvious that in the struggle for survival, power plant efficiency should be one of the first problems to be attacked—and it must be attacked with daring.

Rare indeed is the average industrial power plant in which substantial savings cannot be made in one way or another.

If wasted dollars could be seen as they float away, definite action would soon be taken, for when it was discovered that the bills are of high denomination, activities certainly would quicken. The concern which cannot afford its own power engineering personnel should not be too hesitant in paying for the technical services of an able consulting engineer. Even the larger plant might benefit by seeking fresh opinions from the outside. One of the largest chemical companies in the country rightly prides itself on its excellent power plants and engineering staff. Nevertheless, a visiting engineer perceived and suggested a desirable change that could be made easily without capital expenditure and produce savings running to nearly $15,000 yearly.

To buy or make power is a question that has been discussed so much that it scarcely seems necessary to bring it up again, yet many establishments will soon face the issue of buying additional power or else increasing power production facilities. In a general sense, the

As the author remarks: "Rare indeed is the average industrial power plant in which substantial savings cannot be made in one way or another."

problem is controversial, but when applied to a definite case, the facts will usually point the way. The steam-electric balance might indicate a 15 per cent return on money spent on power house extensions, but the same money might possibly bring 50 per cent when invested in the processes.

Buying power to the very best advantage is an art and demands as much skill as is required in making it. Choosing a tariff, signing the contract and paying the bills are necessary steps, but they are the simplest part of the problem. Most industrial rates are based on a "demand charge" and an "energy charge." The demand charge is designed to cover fixed costs while the energy charge depends upon the actual amount of energly used. The demand charge in the schedule is figured from the highest "maximum demand" or "peak loads" during the month, for a time period of from 5 to 30 minutes, according to the contract. The 30 minute period is generally used and is most favorable to the consumer.

The stipulations covering "maximum demand" and the equivalent charges should be studied carefully, for it often happens that a plant pays a regular monthly rate that is entirely too high, due perhaps to a few unnecessary peaks. The demand can be reduced by better motor operation, a higher power factor and by staggering the electrical loads where possible. Poor power factor, the ubiquitous imp of the power house, can be made to more than pay its way by fitting motors to their jobs and by installing such corrective equipment as synchronous motors, synchronous condensers, static condensers, etc. Space does not permit a full discussion of the subject of buying power more economically, but the thought is left that the plant owner who seriously delves into it will probably find out something he should know.

A division manager of one of the largest utility systems in the country is authority for the statement that: "In nearly every instance where our engineers have made recommendations and suggestions for reducing electric power costs, the results of the investigations have indicated that material savings could be effected. We are interested in seeing that the customer purchases power as economically as possible, for it not only is advantageous to him, but it also promotes good will. The customer should not be reticent in calling for this service."

IN the effort to obtain a lower operating cost of producing steam and electricity it should first be determined whether the department is in the hands of competent operators. There simply is no substitute for good men. After visiting a large number of chemical plants, one is struck by the varying types of personnel found in the power departments. In one place the men can be likened to a well balanced football team with every one alert and on his toes to carry out the orders of a capable chief. The management understands the business of power generation and one is not surprised to learn that the costs are low while the efficiencies are high.

In another instance the responsible head is more theoretical than practical and has a predilection for involved bonus systems. The results obtained are only fair and it is not hard to see why. Time spent in the office working up elaborate curves and charts might be better employed out in the plant studying the men and equipment. It may sound like heresy but it is nevertheless true that although bonuses have their fields of usefulness elsewhere, in the power house they may possibly be an admission on the part of the management that it cannot otherwise get things done right. In still another place is found the other extreme where the chief engineer is so busy doing odd jobs himself that he loses perspective—as well as money for the company.

The days of the scoop shovel and wheelbarrow are about over. The oldtime engineer whose forte was indicator diagrams and valve setting is giving way to the new type who not only knows boilers, engines and turbines, but is capable of analyzing the work in engineering and economic terms. He is not only able to figure accurately the costs of various services and discover weaknesses, but he can also determine the remedy and present his case on economic grounds. Many of these men are technical graduates while others, who have not had the advantage of formal training, through private study are just as able and well grounded. Thermodynamics and even chemistry are replacing the old rule-of-thumb methods in the power house, and it is hard to imagine how the best results can be obtained without the aid of high-grade men.

HERSHEY Chocolate Co.'s power plant at Hershey, Pa., where a modernization program has been carried out by Albert C. Wood, consulting engineer, of Philadelphia. Three new 450-lb. steam generating units, capable of delivering 150,000 lb. of steam per hour, are fired with pulverized fuel dried in the mill with preheated air at a temperature of 400-475 deg. F. The mills are driven by synchronous motors

A power plant can be judged to a great extent by its instruments and the use that is made of them. They are not only indispensable in the boiler and turbine rooms as an aid to economical production, but are invaluable for insuring economy in usage when placed at strategic points in the plant for measuring steam, electric current, water and other services supplied to the processes. If the management does not furnish adequate meters and instruments, it might as well ask the men to do their work blindfolded, so far as the cost sheets are concerned. Wherever possible meters should be the recording type and placed where the operators can easily see them and make use of them—not in the superintendent's office.

Where daily record charts are properly stamped and approved more importance is attached to them by the operators, especially if abnormal charts are returned for explanation. By maintaining adequate records and properly analyzing them, it is usually possible to save 20 per cent or more of the steam cost. Some of the departmental savings that have been made in various plants by proper metering are astounding. When there is no meter on the steam line and the valve is handy, with apparently an inexhaustible supply, the probability is that enough steam is being wasted to pay for a meter in a short time. The plant head who is considering an expenditure for meters should not be content to approve the requisition; he should see that the resultant information is used continuously and to the fullest extent.

In the work of modernizing or rehabilitating a power plant it is not always necessary to make a huge initial investment. In New York City a medium-size power plant changed engineers and within a year the fuel bill was cut exactly in half, in addition to other material savings. Even the city water consumption was reduced 69 per cent. The rehabilitation program included only one real investment, a new unaflow engine. A Chattanooga, Tenn., manufacturer replaced obsolete compressor drives in his two plants with four 125 hp. synchronous motors. The savings in one plant amounted to $9,740 and $4,253 in the other—over the previous year's cost. A total investment of $13,993 was returned in less than a year. A California concern spent $11,700 on synchronous motors. Improved plant power factor and greater efficiency produced a saving of $3,800 annually, or over 33 per cent return on the investment.

ANOTHER plant, located in North Carolina, replaced its old power plant equipment with a turbine to provide power and process steam. The installed cost was $19,200 and at present the saving is at the rate of $13,500 per year, with depreciation and other charges included. The result was a 70 per cent return. A chemical plant operating six large return-tubular boilers found its steam demand apparently greater than the boiler capacity, and the purchase of an additional boiler was contemplated. The situation was carefully studied and the final result was that instead of buying a boiler, the concern found itself with a spare, because five boilers could actually carry the load if given a chance. By cleaning out and enlarging the combustion chambers, rearranging bridge walls, cleaning scaled tubes, splitting the load evenly between boilers and adopting a better method of firing a large, needless expenditure was avoided.

No plant can afford to postpone rehabilitation of power plant equipment, for the plain reason that a dollar saved in the boiler room is worth just as much as a dollar saved in the department processes. Obsolete, handfired, low-pressure boilers and wasteful auxiliaries may be the difficulty, as well as a lack of instruments and other necessary operating equipment; but by making small, planned investments from time to time, instead of plunging, it is entirely possible to work out an economical pay-as-you-go plan.

The first step is acquiring necessary instruments and meters which cost little, bring an immediate return and fit future conditions. A higher-pressure boiler can be installed to replace two or more obsolete units, the new boiler being operated at the old pressure for the time being, while at the same time steam generating costs will decrease. A new turbine later and the steam pressure goes up and costs go down. One step can logically lead to another and the owner will be ahead at every stage.

True recovery can only come when industries begin to buy capital goods in the form of new equipment and repair parts for present machinery. Not only is it to the advantage of the purchaser from a savings standpoint, but it is patriotic as well—a two-edged sword in the battle for recovery under the NRA.

By H. L. DERBY

President, American Cyanamid & Chemical Corp.

How CHEMICAL INDUSTRY Looks at N.R.A.

THE NATIONAL INDUSTRIAL RECOVERY ACT was passed by Congress in the belief that some heretofore unused and untried methods were necessary if American business was to meet the changing conditions occasioned by the economic collapse of 1929. Its proponents have frankly termed the law an experiment, and, while urging all to support it loyally, have stated that if, as drafted and enforced, it does not operate successfully, then such changes will be made as are necessary to bring about additional reemployment of labor and a general readjustment of prices. Experience of the last few months leads to the inescapable conclusion that at this time there is no one so far-sighted as to foretell accurately the outcome of this gigantic experiment. That chemical industry generally realized the seriousness of the situation is quite clearly emphasized by the whole-hearted cooperation extended to the President and his co-workers in endeavoring to carry out the purposes of the Act.

The sponsors of the law no doubt thought that each branch of business activity could adjust and supervise its own problems and policies to the end that there might be no excessive production and that labor would find continuous employment. The latter, in fact, was the chief concern of the authors of the plan. Last June it was estimated that there were 14,000,000 men out of employment and so the great problem confronting the incoming administration was to put these men to work. To that purpose, every thinking person heartily subscribed. The accomplishment of this task is a problem which, after six months of effort is still giving tremendous concern. The voluntary "share-the-work" movement, which was undertaken during the Hoover administration, had proved ineffective for a division of the total labor hours available under existing conditions of depression was insufficient to provide a living wage for all workers. Therefore, it became necessary that the rates of wages be adjusted upward to a basis which would provide the greater number employed with a sum equal to the necessities of life for the worker.

Prices of commodities had declined to a level which in most cases was inadequate to pay the expenses of operating plants. Price increases were recognized by the administration as absolutely essential to the recovery of an equilibrium that would enable industry to continue operations and pay the higher wage rates desired. So many economic theories were advanced as to how all this might be accomplished that many employers were completely bewildered during this period of transition. Some 4,000,000 men are now said to have been returned to employment. There has been a tremendous increase in the total payroll account of the country. Few industries at this time can foretell accurately the profits or losses they will sustain in future month-to-month calculations. The old law of supply and demand, which heretofore has been a prime factor in price determination, seems to be relegated to the discard; and, unfortunately, in its place comes no basis on which to plan conservatively and safely.

However, the complexities of our economic system are more completely realized now than in the past. The responsibility of attaining economic recovery rests with business leaders. The knowledge that these men are giving unstintingly of their effort and ability leads to the hope of ultimate success. The progress that has so far been made in the adjustment of the difficulties of this reorganization of business furnishes added belief that the country is on the way back. Whether or not N.R.A. is ultimately discarded or changed and modified in the future is immaterial, so long as the result of this gigantic effort at cooperation brings about some measure of prosperity.

Thus far, the plan has been largely directed to the formulation of codes of practice. The second phase, the application and administering of the codes, is just beginning. Thus, industries whose codes have been

approved and made effective by the Government are now able to appraise the possible effects upon industry as a whole, as well as on the individual business. It is generally admitted by those most actively engaged in the development of codes that a somewhat new relationship is necessary. Not only must each industry cooperate more effectively than heretofore, but it is also admitted that the individual business must itself be adapted to the new conditions.

The old cut-throat competition, which was encouraged by the Sherman and Clayton Acts, was seen to be a menace to recovery, and under N.R.A. is frowned upon and forbidden. This sort of competition, actively practiced in some industries, encouraged sweat-shop labor, low wages and undue hazards to capital. Today, it finds no favor in the mind of any thinking person. The fundamental principle, therefore, that the rates of pay in the various industries should be on a parity is in itself a step in the desired direction of stability. In a country the size of ours, with living costs varying widely in different geographic locations, the problem of the administration in fixing these rates in fairness to labor and industry is a most troublesome task. To impose upon any industry costs of labor which are so high as to bring disaster to that industry would defeat the purpose of the Act. Leaving out of our present consideration the question of export trade, if the costs of producing domestic articles reached such a high level that our tariff barriers were inadequate to protect us against ruinous foreign competition made possible through low foreign labor rates, then our employment would be reduced instead of increased. The administration recognizes this contingency and has promised adequate protection against that eventuality.

MINIMUM wage rates with the maximum hours specified in the various codes makes imperative the efficient use of labor, and an effective method of budget control of operations becomes highly essential. The reduction or elimination of waste is likewise a necessity. Executives are giving thought to processes and procedure, revealing in many cases the inadequacy of existing machinery and equipment, improper plant locations, and unsound policies and methods in distribution. They realize that large volume at low profit per unit will be replaced by smaller volume, and, if profits are to be attained, they must come through more efficient operation and the elimination of waste.

Long before the depression the high cost of marketing was a subject of serious consideration. Production economies have been absorbed to an alarming extent by the increasing cost of placing finished goods in the hands of the consumers. It has been thought by many that marketing and distribution could be carried out in the same scientific manner as production, but there has been no coordinated effort, or agreement of ideas, as to any standard form of procedure. Advertising expenditures are being closely scrutinized, and promiscuous programs replaced by a more discriminating selection of mediums based upon demonstrated results. It is also quite possible that codes may influence future advertising programs by changing the emphasis from price to quality and service.

Several codes declare that the sale of goods below the published and registered prices is an unfair practice. This is a revival of the open-price methods of trade associations. Prior to the enactment of N.I.R.A., the interchange of price information and other statistical data through the medium of the trade association was not illegal, unless used to effectuate agreements or understandings to fix prices. Much was legally possible under former laws to stabilize conditions in industry. Unfortunately, however, the ill-advised methods of some trade associations placed the legitimate activities of others under a cloud of suspicion. A trade association disseminating trade statistics, including prices, when not done for the purpose of regulating prices or controlling production, has been described by one of our courts as, "A bureau of intelligence and one which makes for real, rather than artificial competition in trade." Under most of the codes the gathering and dissemination of trade facts is necessary and has the backing of N.R.A.

A WIDER latitude than formerly existed has been given to industry, but this does not mean that all restrictions have been removed. The area of cooperative effort has only been extended to certain activities heretofore illegal, and there still remains a considerable area of illegal activity. Before the enactment of N.I.R.A., selling below cost was illegal only if indulged in for the purpose of injuring a competitor. When specifically provided for in a code, selling below cost is declared to be an unfair practice regardless of motive. The old law possibly still continues to apply where the subject is not specifically mentioned in the codes. This illustrates the uneven line drawn by the codes through the economic structure, since that which constitutes violation in one industry may not be violation in another. The proposal to adopt uniform accounting methods and the application of the prohibition against selling below cost raise immediately questions which suggest that those who advocate such provisions still have to demonstrate the practicability of their plans.

In industry there are such wide variations of costs that a manufacturer might be forced out of a market in which he has established himself at great expense, by reason of the fact that his cost, at any given time and perhaps only temporarily, would exceed the existing prices fixed for the commodity by others enjoying either temporarily or permanently a lower cost. The unfairness and economic unsoundness of such a condition is readily realized by any who have thought through this problem.

IT WOULD seem that leaders in agriculture and industry owe the nation the responsibility of reducing to a minimum the cost of selling and distribution of products. The lower a product can be sold the greater is the incentive of the consumer to buy. If the costs of distribution and selling are excessive, the consumer is injured and the sales possibilities are restricted. An economist has said that prosperity comes through the maximum consumption of goods. To realize that maximum possibility it becomes necessary to eliminate economic waste. The greater the consuming market, the greater the production, and the cycle of employment and consumption increases proportionately.

By **T. R. OLIVE**
Associate Editor, Chem. & Met.

Are You Paying For NEW EQUIPMENT You Never Get?

MILLIONS FOR "TRIBUTE" but not one cent for defense is not a statement that would be well received in a corporation's annual message to its stockholders. Yet how many millions American manufacturers are contributing annually to the twin public enemies of obsolescence and equipment decay, nobody knows. Suffice it to say that the figure would be startling; if it were known neither management nor stockholders would countenance it for a moment, for the loss to the owners and the public would make the depredations of our human public enemies puny and even charitable by contrast.

Most process industries, by reason of their comparative youth and freedom from the empiricism of older producing groups, certainly suffer less from unnecessary costs than the run of industry. But the fact remains: old and outmoded equipment and processes do take their toll. Low production efficiency is not the virtue some people would make it appear. Equipment that is kept in operation despite the termination of its normal useful life, or despite the advent of something much better, is paying for its replacement in machines that are never ordered, never built and never installed.

If it could be demonstrated that a certain step in handling materials, for instance, was eating the cost of a new conveyor every six months, the manager who clung to the old would find little sympathy from his directors. If it could be shown that money to be had for 5 or 6 per cent would earn 25 or 50 when converted into a new crystallizer, it would be poor business not to borrow. And yet many such cases exist in chemical plants, ready to save money as soon as they can be discovered—and *proved.*

It is the proof of the benefits to be derived from modernization that is the most difficult part of the program. In the natural course of events, equipment wears out and is replaced. Under the least favorable circumstances, the replacement machine may be no more efficient. When to replace? Under the most favorable, something much better may become available long before the existing equipment has reached the end of its supposedly useful life. When to throw out the old, install the new? What is modernization worth in dollars and cents? What opportunities are being ignored for want of accurate evaluation of the penalties extracted by "conservation of assets?"

Numerous methods have been proposed for determining the value of modernization. Generally they are put forth as a formula purporting to show that the new equipment will pay for itself in some particular period, or that the return on the new investment will be so and so many per cent a year. Customs differ as to the required "pay-for-itself" period, which according to the hazards of the business, the likelihood of obsolescence, and the idiosyncrasies of the person who sets the figure, may be anywhere from six months to five or more years. An increased return of 20 to 25 per cent on the investment, capable of returning its cost in four to five years, is the most usual requirement in the chemical industry. This range is probably reasonable, but it is not the intent of this discussion to debate its suitability. Rather our aim is to look into the components of "useful life" and examine the factors that make up the true worth of modernization.

In comparing the probable performance of a new machine with one at present operating, it is usual to assume that costs with the existing equipment are static (barring outside influences). This assumption, alone, is responsible for a large proportion of the failures to replace at the economic point, for it is demonstrable that with many sorts of equipment, production cost increases more or less sharply with age. Take the simple case of the family automobile which becomes more and more expensive to operate and maintain during its declining years. Is it unreasonable to suppose that in production machinery, there are many other factors which also tend to increase? Wear in moving parts is cumulative; maintenance increases as corrosion makes patching more and more difficult;

old and cranky devices demand an increasing share of operating attention; operation becomes less reliable and product spoilage tends to jack up costs. Further than this, fuel and power requirements often ascend. Insurance, as in boilers, may increase. These are but some of the ways in which equipment passes from the stage of asset to that of liability. The problem is to determine the transition point.

In the simplest case, equipment runs its useful life because nothing better becomes available for its replacement. Should the operation period be either more or less than the useful life, loss is certain to result. One of the commonest fallacies of management is to assume, because a machine has been "written off," that it is a low-cost producer. Take the case where after 100,000 units of production the operating cost of a certain \$6,000 machine has been increased by \$0.12 per unit. A mere \$0.12 in comparison with \$6,000—but, nevertheless, an indication that the useful life of the machine has been exceeded. This simple problem will permit us to define useful life for all cases where obsolescence does not become a factor.

In the first place, it is a primary principle of costing that every unit of production must bear its proper share of the cost of the machine (depreciation charge), to the end that when the machine is retired, money will have been set aside for its replacement with a machine of equal cost. In the case of the \$6,000 machine above, Fig. 1 illustrates two possible paths which the cost per unit (not including depreciation) might have followed in increasing by \$0.12. Depreciation is an added charge which, as it will appear, must bear a relation to the cost-per-unit history of the machine. Let us redraw the curves of Fig. 1, taking into consideration the depreciation charge. The method chosen is not the one used in accounting, obviously, but it is the one which makes the effect of varying costs on surplus the most apparent. Note that in the charts of Fig. 2 *areas* represent cumulative totals of constant costs, variable costs, depreciation reserve and profits. Thus in (*a*) the depreciation reserve area represents $100{,}000 \times 0.12/2 = \$6{,}000$ or the cost of the machine. In other words, at 100,000 units the machine has completed its useful life, for any attempt to operate it longer would project its cost-per-unit into the area of profit. Now take (*b*) where the question is not so simple. In (*a*) the variable cost area equalled the depreciation reserve area at 100,000 units. Such is obviously not the case in (*b*). Here the boundary line between the depreciation charge and profit is so chosen that the depreciation area still equals \$6,000, but the useful life, x'', the cost increase, y'', and the area of variable costs are all smaller than in (*a*), while the profit area is larger. But, as in the latter case, any attempt to operate beyond x'' will eat into the profit area and yield a lesser total profit.

Thus we see that while there is a relation between useful life, depreciation charge and variable costs, it is not readily defined except by graphical methods. Take the still more difficult case shown in (*c*) where the cost increase follows no obvious law. The area between the cost curve and the depreciation-profit boundary must still equal the cost of the machine, or \$6,000, but the value of x'', y'', the variable-cost total and the profit total will be different.

As a general definition, then, the useful life of a machine is that life during which average of the sum of all costs per unit, including depreciation, will be a minimum. As a general proposition, the way to determine this is by the graphical method shown, plotting

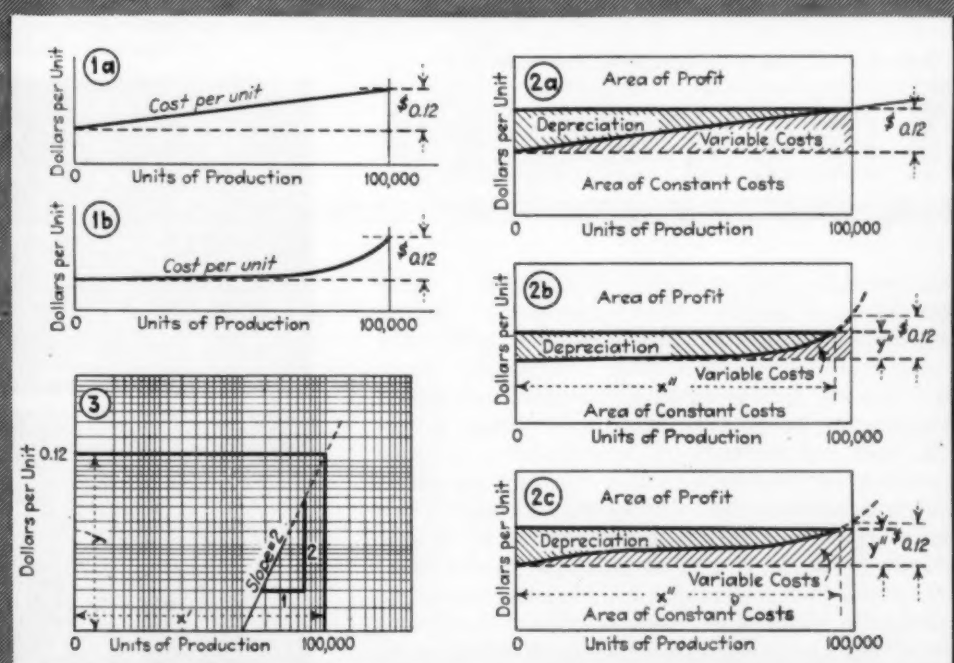


Fig. 1—Two possible ways by which cost-per-unit may increase by \$0.12 during the production of 100,000 units; (*a*) illustrates a straight-line relation and (*b*) a relation where costs increase at an increasing rate

Fig. 2—Curves of Fig. 1 redrawn to include depreciation and to illustrate the determination of useful life; (*c*) shows a case where the cost increase follows no obvious law

Fig. 3—Cost increase, if it follows a power law, will plot as a straight line on logarithmic paper

the past cost history of the machine and extrapolating to determine its probable future performance.

The writer does not have enough data to prove this theory, but believes it is probable that the actual process of cost increase for many different types of equipment will follow a law of the form $y = ax^n$, where y is the cost increase per unit, x the number of units of production and a and n constants for the case in question. Many cost records on the books of equipment users should prove of extreme value in determining the true present worth of this equipment. A simple method which may save the laborious square counting required by the graphical device above is to plot the cost increase (not including depreciation), on logarithmic cross-section paper. If the increase follows a power law, it will plot as a straight line as in Fig. 3, the slope of which (2 in this case) is the exponent, n, of the equation. Determine by extrapolation and inspection the values of x' and y', where $x'y'/2 =$ \$6,000, the cost of the machine. The equation is then

$$y = y' (x/x')^n \text{ or } y = 0.12 (x/100{,}000)^2$$

For any case where the cost increase may be written as a mathematical expression, x'', the useful life, may be determined by evaluating

$$x'y'/2 = x'' f(x'') - \int_0^{x''} f(x)\, dx$$

For the case given,

$$\text{useful life } x'' = x' \left(\frac{n+1}{2n}\right)^{\frac{1}{n+1}} = x'K$$

$$\text{and cost increase } y'' = y' \left(\frac{n+1}{2n}\right)^{\frac{n}{n+1}} = y'K'$$

The values of K and K' for various values of n are listed in an accompanying tabulation for ready use. It is apparent that for costs following a power law, the useful life is never less than about $0.9x'$, whereas

Values of K and K' for Various Values of n

n	K	K'	n	K	K'	n	K	K'
1.0	1.000	1.000	3.0	0.904	0.738	10.0	0.947	0.581
1.3	0.948	0.936	4.0	0.910	0.687	12.0	0.953	0.568
1.5	0.929	0.896	5.0	0.919	0.652	14.0	0.959	0.558
2.0	0.909	0.826	6.0	0.926	0.630	17.0	0.966	0.551
2.5	0.904	0.775	8.0	0.939	0.600	20.0	0.970	0.541

the cost increase approaches $0.5y'$ for the limiting condition where a machine, after an exemplary life at constant cost-per-unit, suddenly becomes prohibitively costly to operate.

Before passing to the effect of actual obsolescence of equipment, let us examine what occurs when a machine is operated beyond its useful life. Certain equipment is found to stabilize at a constant operating cost and maintenance rate during its old age. The apparently logical conclusion then is that such equipment should be operated until it falls apart, or at least, until something better is available. Fig. 4 shows what most probably happens in such a case. After the passage of its useful life, the machine's added costs simply eat up the depreciation reserve so that the end of, say, 190,000 units, the machine is not only ready for the scrap heap—but its replacement money has disappeared.

Useful life, as it has been considered above, is the determining factor only where the machine would have to be replaced with one of the same kind. Should another machine of sufficiently greater efficiency become available, it would immediately be economic to substitute the new machine, even at higher investment cost and even though the original useful life had been far from exceeded. Under these circumstances there are three cases: the first where the cost of the new, more efficient machine is the same as that of the old; the second, higher; and the third, less.

Take first a case where the new machine has the same first cost as the old. Under this circumstance, the interplay between the book loss on the old machine (book value minus scrap or resale value) and the increased saving with the new, determine both the optimum time at which to make the change and the value of the change in terms of the new investment. This situation is illustrated in Figs. 5 and 6. The first step in setting up such a picture is to determine the cost-per-unit *vs.* depreciation area for the old machine, and estimate it for the new. When these have been plotted for some assumed time of replacement, it will be evident that the book loss on the old machine must be added to the investment for the new one. Since the actual investment in both is the same, interest on the investment need not be considered—*but,* interest on the book loss is a legitimate charge against the new machine and so must be added to its cost of production. Since the book loss will be amortized over the life of the new machine, the interest will be substantially one-half that on the total book loss. It will be evident from Fig. 5 that had the

Fig. 4—How the depreciation reserve disappears when a machine is run beyond its useful life

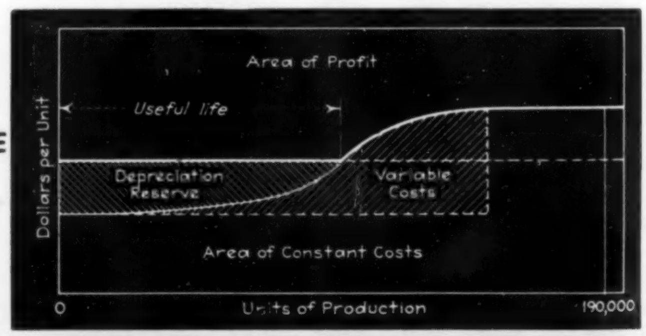
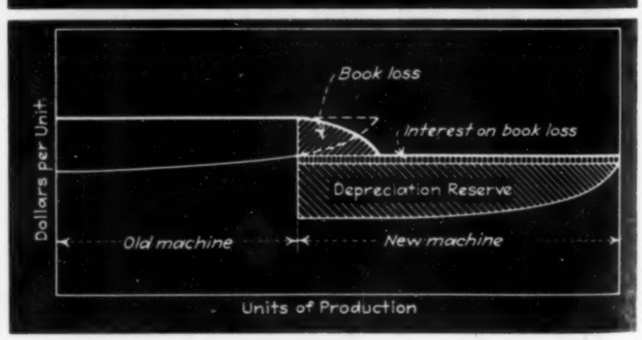


Fig. 5—Effect of replacement with a more efficient machine of equal investment cost



replacement been made either earlier or later than as shown, the total profit for the entire interval would have been slightly reduced.

The determination of the return on the new investment is accomplished similarly. For convenience, the book loss in Fig. 6 is shown as a constant charge. By comparing the added profit area for a year with the total investment (including the interest area), the annual return percentage may be calculated.

The cases where the new machine costs either more or less than the old are similar except that the former involves an added charge, required to amortize the added capital, and the latter an added profit. It may not be entirely obvious that a more expensive machine requires an amortization charge over and above its increased depreciation, but that this is the fact will be evident when the additional capital is borrowed from an outside source. In this event, it is clear that the new machine would not only have to bear a depreciation charge that would replace it, but it would also have to carry a charge to amortize the loan, as in Fig. 7. The situation is identical when the added capital comes from surplus, for then it must be returned to surplus over the life of the new machine if the total profits are not to be reduced by the change. If the new machine can do no better than return the added investment, it is no improvement, for it would be taking money from one pocket to put it in another. Furthermore, interest on the book loss and on the added investment are charges against the new machine. They are not costs of the *business,* deductible for tax purposes, but they are costs of the *machine* in comparison with earlier machines. Again, the annual percentage return is determined by comparing the increased profit with the sum of the investment and book loss plus interest on the book loss and added investment.

When the new machine costs less than the old, the reduction, distributed over its useful life, is an added profit for the machine, in addition to the profit from reduced depreciation charge. The interest on the reduction is also an added profit.

There are other cases which can be handled similarly. For example, where a machine such as a conveyor is substituted for hand labor, the picture is exactly that of Fig. 7 except that there can be no charge for book loss nor for interest on the book loss (unless shovels and wheel-barrows are to be written off). When the cost of operation goes up, not through any fault of the machine, but because the NRA has increased raw material and labor costs, the useful life remains the same because an identical machine would be subject to the same cost increases; but modernization becomes even more attractive because of the proportionately larger potential savings to be made. A new machine under these circumstances will be more costly, but its savings in terms of dollars, will be larger.

The foregoing analysis, because it includes the factor of increasing cost-per-unit, gives a more accurate representation of the improvement to be effected by a new machine than can a formula which depends on the cost for one particular short period of time. Except graphically, the varying cost-per-unit concept is difficult to handle. However, if it will be borne in mind that the costs-per-unit referred to are the average of those anticipated over the useful life of both the old and the new machine, the formula presented above will give the same results as the graphical method which, of course, expresses the same relations.

DETERMINING RETURN ON INVESTMENT IN MODERNIZATION

(Note: All costs should be the average unit costs that may be expected over the useful life of the machine)

Savings per Unit, $

- (*a*) Saving in direct labor
- (*b*) Saving in supervision*
- (*c*) Saving in power or fuel*
- (*d*) Saving in maintenance*
- (*e*) Saving in depreciation*
- (*f*) Saving in insurance and taxes*
- (*g*) Reduction in investment*†
- (*h*) Interest on reduction in investment*†
- (*i*) Reduction in spoilage
- (*j*) Increase in value through higher quality
- (*k*) Saving in raw material

Sum of savings $= S$

Losses per Unit, $

- (*l*) Book loss on old machine†
- (*m*) Increase in supervision*
- (*n*) Increase in power or fuel*
- (*o*) Increase in maintenance*
- (*p*) Increase in depreciation*
- (*q*) Increase in insurance and taxes*
- (*r*) Increase in investment*†
- (*s*) Interest on added investment*†
- (*t*) Interest on book loss†

Sum of losses $= L$

When all savings and losses have been computed and totaled, then:

$$R = \frac{100(S - L)U}{C + (-h + l + s + t)UE}$$

where R is the annual percentage return on the investment in the new machine; U is the number of units produced per year; C is the cost of the new machine; and E is the economic or useful life in years.

*May appear either as a saving or as a loss.
†Per unit over the useful life of the machine; see Fig. 7.

Fig. 6—How the annual percentage return on the investment, for the case of Fig. 5, may be portrayed

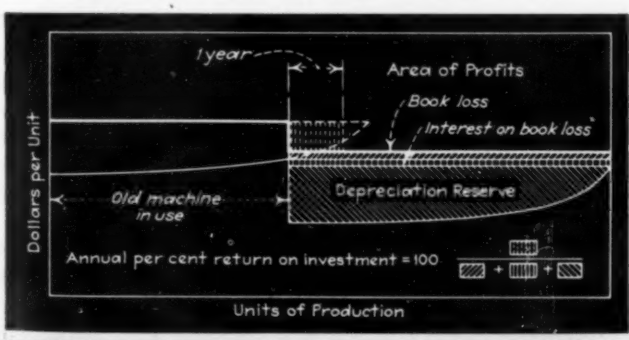
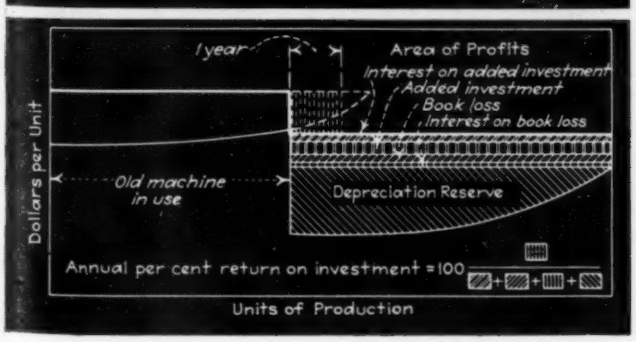
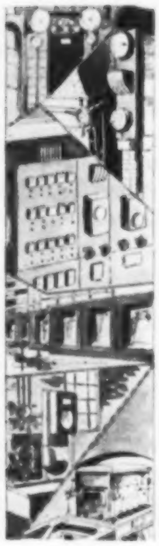


Fig. 7—Illustrating the situation where the replacement machine is more efficient and more costly





By **J. Y. SMITH**

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PROCESS CONTROL— Its Place in Modernization

IN THESE REMARKABLE TIMES when so many new notions are being bandied about, it is pleasant to find that a new freedom exists to discuss things without the fear of being conspicuous or "eccentric." This freedom even extends to the discussion of the manifold phases of the gadgetry that is Process Control, and how these gadgets—given a chance—can upset some of the sentimental attachments for fine old processing tricks that have long stood in the way of a general cost realignment. These times are perhaps a little uncomfortable, but they are salutary, for most people have quit trying to hide the badge of human frailty. "What-was-good-enough-for-grandfather-is-good-enough-for-me" is not such a successful boast as it used to be, and industrial Rip Van Winkles, emerging from the long hibernation of the last four years, are finding that the old outfit makes them just a bit ridiculous in 1933. If they wake, for example, to the belief that all is sweet fraternalism, and that under the codes they can sit back and unload administrative responsibilities on a willing government, they are overdue for rude enlightenment. Once back in the swing, it may be predicted with confidence that instead of brothers-under-the-skin, they will find their new competitors adept in refined cruelties. New efficiencies, new accuracies, new high levels of quality will force them to abandon the rags of 1929 in favor of new clothes, new shoes, a knife, a watch, a pocket lighter and other modern paraphernalia. The sooner these anachronisms discover today's requirements, the quicker they will be ready for tomorrow.

On the surface, the principle of avoiding, in every permissible way, leaving something unnecessarily to chance, seems to be a harmless and pious sort of notion and yet it is rife with startlingly useful possibilities. Process Control, which is this principle's more usual name, has been subject to the unfortunate habit that many people have of splitting the term. Process, of course, is a familiar thing around almost any plant in the industry; but Control, to the vast detriment of Process, has been considered by too many people as a thing apart. In too many minds there is the fallacy that (process) control apparatus is "just a lot of exorbitantly priced merchandise belonging to the class of expensive luxuries . . . " Yet, to the men who understand the skill required to maintain equilibrium in a process, such a remark is peevish nonsense. When Measurement and Regulation are omitted from consideration along with the stoichiometry, the thermodynamics and the materials and the energy requirements of a process, one of the last is certain to get out of balance, at the cost of time, money and somebody's prestige. Perhaps reprieve may come through a miracle of ingenuity of the instrument makers, but it is absurd to leave such a reprieve deliberately to chance.

One wonders why, in the past, it has been so difficult for the Process Man and the Instrument Man to get together, to their mutual benefit. The former is a constructive worker, as distinguished from the profit-taker and racketeer of business. He is in the business of producing a commodity such as salt, shoes, soap or sox, or some other commodity intermediate between such finished states and their raw beginnings. He has the problems of administration and marketing in all their extensions, refinements and complications.

The Instrument Man is also a constructive worker in the same distinctive sense as the Process Man. He is in the business of contriving and systematizing mechanistic devices which will increase and refine the power of the five human senses in control over matter and energy. Necessarily then, this involves Process Control. If a question in the technology of processing is put to him, he is obligated to give it strict attention. So infinitely large are the categories of matter, energy, technology and measurement wherein he must perform that he cannot anchor his policy, his workmanship and his speech to a commodity like salt or soap.

Whereas a processor can successfully anchor his policies and suchlike to his commodity, the instrumentician is exasperated to find that his policies, workman-

ship and speech are hampered rather than helped by any attempt to use his instrument as an anchorage. In the active usefulness of these two to each other there are stalemates which seem absurd but which exist anyhow. An intelligent processor will have the sincere opinion that a certain device which he wants is simply not available; an intelligent instrumentician who has developed the same device will at the same time consider it unmarketable. The whole situation involves a tremendous amount of negligence; yet close observation shows it to be mainly inertial rather than willful.

Wherever a system has gone wrong, it is much easier to withdraw without a word or to withdraw with a denunciation of somebody else, than it is to examine the layout and try to do something about it. The latter course, aside from being difficult, is most often a thankless one; but it is certainly worth an earnest effort in the matter at hand. There is no reason why a convenient analytical method should not be used, provided of course that it can work.

In the process industries there are identified weaknesses:	In the apparatus industries there are identified remedies:
1. Quality of end product, lacking not only progressive improvement but sustained uniformity.	1. Measuring and regulating apparatus capable of greatly extending and refining the five senses of a process operator; challenging him to become more interested in what he perceives more clearly; inducing an increased skill to meet the more clearly focussed faults; enabling him to see enough of process sequences to gage uniformity and add progressive improvement.
2. Continuance of kind of end product which fails to do justice to existing markets or to materials and equipment **available.**	2. Refined measuring apparatus bringing out unsuspected values in familiar stuff, leading to new qualities in old products and to new products; refined regulating apparatus easing the operating strain sufficiently for better thinking on new advances.
3. Adherence to outworn customs to the extent of cancelling improvements in other processing customs.	3. Measuring and regulating apparatus in combination with an improvement both to demonstrate it and to measure it.
4. Neglected opportunities to romanticize certain process features which could profitably attract interest of product buyers and of process operators.	4. Measuring and regulating apparatus which, by its refinement and extension of the five senses, brings out processing features which are interesting enough for people in general to discuss or are stimulating to both product marketers and process operators; (*e.g.,* the well known "shot from guns" variety of foodstuffs).
5. Waste of material and power.	5. Refined measuring apparatus which is expert in plant accountancy; it determines maximum and minimum demands, load and diversity factors; it keeps running totals and segregable subtotals of energy, gas, liquid and solid; it acts as economic judge and examining attorney for apparatus on trial.

On these five counts, of the many which exist, the Instrument Man appears to have "what it takes." But the Process Man thus far has not taken nearly enough of what the other fellow has. In theory, it is not likely that such opportunities for mutual assistance can be well known to both parties, but deliberately rejected by either; both parties are much in earnest about their work. In practice a close investigation verifies this; the remedy for a Process Man's difficulty to be found on an inside page of an Instrument Man's catalog, or possibly on the front page but under a name different from the one in the searcher's mind. Both parties in such situations appear to stop just short of making the connection obvious to each other.

The major obstacle which is thus identified is that discouraging old issue of the spoken and written language. It is discouraging because all known remedies for confusion of language usually boil down to the formula: "more of the same." It is discouraging because "Action," which is reputed to speak louder than words, cannot commence in a case like this until after an exchange of words. Both parties may be familiar with the same general language but each of two strictly local dialects lacks precise word symbols for a lot of the important ideas expressible in the other.

IN the matter of dialect and other features of his business, the Process Man gets a more or less lucky break. There are phases of his business wherein he can be swamped in technicalities; but he can (and too often does) rescue his self-esteem by reverting to the familiar ground of his product and the buying and selling thereof. In other words, when he reaches a point of uncomfortable mental stress in trying to understand and be understood, he can step back and say, "Now I'm tired of playing this way. You'll have to come over and play my way or else the game's off."

But in the dialects and other features of the Instrument Man's business there are few avenues of escape. This man is compelled to be more precise than most others and—as happens to most precise people—he becomes tiresome to many who attempt to follow him. The multiplicity of specialized and unrelated problems which are shunted on to him compel him to set up a generalized sort of dialect to handle all the specialties. In other words, if he were to fill his skull with the salt-processor's dialect, he could not be very intelligible to the soap-processor. What helps still less is the compulsion to throttle any spontaneous enthusiasm which might betray a salt man's "secret" to a soap man or to another salt man. Then there is the matter of attention which the Instrument Man's business requires that he give to the non-processing scientific researcher's problem. Consequently the resultant linguistic hodgepodge of the Instrument Man is bound to be everything in general and not too much in particular. The kindest possible name for it is "Abstract Terminology."

The foregoing diagnosis of the chief ailment of Process Control apparatus—as an affliction of languages—has turned out to be just about as difficult and discouraging as was expected. It was predicted, on experience, that basic remedies for an affliction of words had the drawback of consisting largely of more words. But experience plus instinct dictate the wisdom of writing

both Action and Words into the prescription. Alternate doses are prescribed with the caution that impulsive variation of such sequence may make things worse. The prescription reads: (1) Time Allowance; (2) Words; (3) Action; (4) More Words; (5) More Action; and (6) Results.

Ingredient (1), the time allowance, is a sacrifice for both Process Man and Instrument Man. Probably the Process Man will sacrifice less time but suffer greater pain in so doing because in the past he has rarely been forced to do such a thing in a case like this. Today, however, is toward the end of a famous period in history and finds the Process Man noticeably readier to try things—even time allowances.

Ingredient (2) should take the form of a short pow-wow involving the instrumentician and the technical and production men of the processing business, with special care being taken to lock out the purchasing and marketing men of the business. Although the discussion need be but short, there are three logical stages to it. In the first stage the conferees should arrive at intelligibility on shop and technical dialects. In the second a maximum permissible knowledge of process operation should be imparted to the instrumentician. In the third the names and synonyms of devices, their necessarily simple principles and their permissible variations should be imparted to the technician and production man.

Ingredient (3) should be a pair of simultaneous and intensive analyses; by the instrumentician in his place; by the technician and production man in their places. In the processor's place, there are at least two jobs to be done. One is to compile descriptions of the phases of process which have been left to guesswork but which common sense says should not be. Another is to drag out those phases of process which are reputed to be measured and regulated but which experience shows not to be right. In the instrumentician's place, the chief task is to translate from abstract terminology to processor's dialect the descriptive matter on devices which the original conference showed to be pertinent. Further work may be necessary to cut, trim and focus specifications on a device whose natural range may be so wide that the processor's special range gets lost somewhere in the middle. It is also likely that other specifications require expansion where older descriptive matter on a device has been put into circulation prior to focus on present specific problems and where, consequently, such descriptive matter implies an exclusion which is not the case. In some cases this involves merely a change of label without altering the device as, for example, changing "Gas Analysis" to an equivalence of "Gas Density." In other cases only a minor modification of construction may be required.

PROBABLY it has been noted that a special feature of this Action of Ingredient (3) is a draft on the Time Allowance of Ingredient (1). Attention is called to this because, over a period of years, instrumenticians and processors have helped each other to form a habit of rejecting this time factor. Each party has been prone to take it for granted that the other has been making these important readjustments like the snap of a finger, in running stride, during an initial conference. Unfortunately such cannot be the case.

Ingredient (4) is another conference—this time with the purchasing and marketing ends of the processor's business invited. At this time the terminology of both processor and instrumentician should be intelligible enough to the previous conferees for maintaining stability of discussion against irrelevancies introduced by the new conferees. Most likely the processor's marketing specialist fits in congenially and he is also likely to take away with him some valuable new material for talking points. But if this conference goes as it should, the purchasing agent will find his pre-depression style pretty much cramped. Nobody denies that the optimum "price, terms, delivery, etc." are important. But the administration of a processing industry goes so far beyond straight buying and selling that optimum "specifications" are just as important, if not more so.

THIS is not a matter of vindictiveness against the friendless purchasing agent; it is merely consistent with the fact that such functions as purchasing, disbursing and accounting have been so grossly exaggerated by the era of chiselling and percentage-taking that reflation is upon us without full realization of it by all concerned. In this prescription (up to this point) the preliminary hearings have been restricted to operators, technicians and instrumenticians because these men have allowed themselves to be bulldozed and because, consequently, the amount by which they have fallen behind has to be made up artificially in order to restore a balance.

Ingredient (5), More Action following previous talk and action, cannot at this time be much more than an extension of the earlier steps. The ultimate purpose of action expected of parties participating up to this point is to get this function of Process Control a great deal nearer to its logical category. It is not precisely known where Process Control belongs among other functions of administration. But it is certainly known that it belongs among the administration functions; that it positively does not belong in crates lying around a shipping-receiving room along with brooms, cuspidors and other ingenious devices purchased over the counter or through purchase-order forms. Process Control Apparatus is very much a tangible part of a skilled professional service, the worth of which is determinable by direct appraisal of loss to the business, as a whole, occasioned by serious lapse in that service.

The foregoing prescription has called for alternate ingredients of talk and action. Of these, (2) and (3), involving the instrumentician and the processor's technician and productionist, are the least spectacular but most immediately useful. These three, being justly left alone with their capabilities and alertness to the issues, can show a tremendous amount of ground covered with remarkably little consumption of time allowance.

Very quickly the two specialists of the processing business can discover practical needs for departing from the strict symbolic sense of prescription. One of the first departures will be upon discovery of a now unfortunate weakness among apparatus makers—namely, that no single manufacturer can profitably make the best of a full variety of devices required for a well-balanced Process Control system. In other words, the symbolic "instrumentician" will have to be endowed with five or six different personalities in order to cover

the whole process. In like manner the "technician" may have to be endowed with analogous personalities of chemical, electrical, mechanical and such specialized types. Perhaps the same practical liberties will have to be taken with the "productionist" and certainly so with the time allowance. But the symbology will surely be found to hold good with respect to the exclusively technical nature of the preliminary steps and with respect to the small total of time consumed in these steps.

IN the sacred name of Practicalities we have just been busy destroying the strict symbology of the original lineup of ingredients and characters. If it now seems expedient to junk the whole fabric of metaphors and go on with new metaphors or none at all, that is all right, too. The facts so urgently required to bring out at this juncture are the following:

First, time is at a premium but reckless haste is also a waste. For this reason it has seemed experimentally sound to set up a limited but adequate store of time allowance in order to frustrate the impulse for panicky haste.

Second, the groundwork for any permanent advance in the usefulness of Process Control must be technical. In order to solidify this groundwork as quickly as possible, it has been necessary to show the important distinction between an adequate treatment and an unnecessarily exhaustive treatment of technicalities. This is why it has seemed experimentally sound to restrict the early phases of words and action to technical men.

Third, stability of technical groundwork arrived at in minimum time is necessary for standing up under impact of the important non-technical factors which come afterward and which do not wait while one particular department takes its own sweet time in coming to equilibrium. If this technical preparation for Process Control works as it is hoped, then the technical man will be as sure of his background as the big Irish cop who says, "No, you can't park here."

Only when the instrumentician, the technician and the productionist have been nursed into a robust assurance of manner will it be safe for them to try to deal on a par with the purchasing agent, the marketing specialist and the various other responsible men of the business. With the assurance and skill of all these men focussing their attention on the problem of Process Control, it will be possible to discard the last pretense of artificial scaffolding. When Process Control has approached its true status, here are some of the things it can do:

It can improve the condition of the industry's books by cutting a large chunk out of the high percentage of guesswork which goes into processing methods, by simultaneously inducing product uniformity and reducing spoilage, by reducing shutdowns and their penalties without resorting to such costly operational safety factors as whole spare pumping, washing, cooling or circulating systems, by making it possible to get the same or better product quality out of lower priced raw materials or out of raw materials where partially finished materials were used before, by reducing plant hazards which all contribute to insurance penalties and by reducing some wastes and eliminating other wastes of power and material.

It can create marketing advantages by reducing costs through means just stated, by eliminating customer alibis for non-uniformity of product, by improving product, by identifying new products and by creating attractive new talking points on older products which have slipped into the obscurity of dead levels in price and quality.

It can create measurable improvement in plant operating personnel (except in plants which do not value such things) by raising the plain operator at least a few notches above blind routine in duties about which he knows only a limited amount and gets to caring even less, by bringing the maintenance man closer to process from his point of detachment, by giving the ordinary plant technical man an excuse to be something more than a hit-and-miss tinkerer or snooper, by giving all these men and the men they call "big shots" something new and interesting to gab and theorize about.

When the processing industries have looked this situation over and have adopted the ideas a few at a time and then have lived with them a while, a remarkable thing will suddenly be discovered. Process Control as a thing apart from the business, as a thing to be cheered for or fought over, will have disappeared. It will have been absorbed and will have lost its identity as part of the business as a whole. Then these industries will be somewhere near the similar stabilized position occupied today by the telephone industry. If all the control devices of the major telephone systems could be dragged out and piled up, the resulting heap could compete with almost any average mountain. Yet in the telephone industry these gadgets are almost entirely out of sight because they are more habitually used than looked at. The idea of communication control is so thoroughly absorbed that no fuss is made about it. The recent machine-switching move, for example, has died down already to an obscurity which would not be reached by a similar innovation in the process industries for many many years.

But the position of the processing industries in 1933 is not the same as that of the communication industries, from the standpoint of condition of the books, marketing advantages, personnel stability and a lot of other things. Yet there is no reason why the processing industries could not make notable progress toward such stability without consuming excessive amounts of time allowance. Obviously this matter of Process Control is only a fraction of the picture. But it has been neglected and, for that reason, must be built up at the cost of temporarily concentrated focus on the part of the many people concerned in the matter.

It is to be expected that, when a number of competent people focus attention on a matter like this, such methods of approach as the symbolic prescription submitted herein will prove to be hopelessly inadequate, if not ridiculous. Quite possibly it will turn out that entirely new functions in industry will have to be set up to take care of Process Control until it can afford to lose its special identity. Probably a new type of technologist, the professional instrumentician, will have to be created. His duties may have to cover the wide gap between hardboiled plant process operation and the divine metaphysics of quantum mechanics. In addition to being an accomplished linguist, he will have to have precise knowledge of the properties of devices—electrical, mechanical, chemical and metallurgical aspects, all in combination.

AND so, to conclude: In the processing industries there are many many genuine and urgent needs for skillfully coordinated Process Control systems; and the apparatus industries are stocked up with ingenuities years ahead of the demand. But the latter, to the detriment of themselves and everyone else, are chopped up into little subdivisions of exclusively specialized gadgets with each gadget bundled up in its own special patents. Hence the present necessity for a parade of specialists and the humdrum prescription of systematically asking questions and receiving answers. At any rate, we shall thus be exhibiting the cardinal virtue of Process Control—namely, to avoid in every permissible way leaving something unnecessarily to chance.

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PREVENTIVE MAINTENANCE

A Necessary Step in the Recovery Program

JUST as machine has multiplied productivity so it has also increased the scope and complicated the functions of maintenance. Old trades have been eliminated; new ones have been created. This is the natural progress, and it will so continue as long as man is able to reason. Sometime in the future we may carry on production without human labor to operate machines but men will always be needed for experiments and repair. The same careful attention given to organization of men and work, the same skill and judgment as applied in the direction of production must now also be devoted to maintenance, as production is becoming increasingly dependent on this factor for its success.

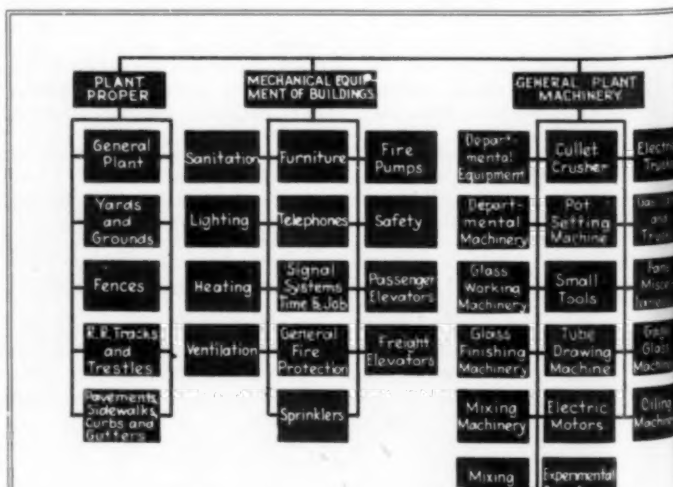
The handy man and "Jack-of-all-trades" who oiled the machinery, repaired and dressed the slipping belt, and cobbled the broken machine is gone. As maintenance expanded with the size of the plant, the first division of labor appeared in the millwright, the electrician, and other groups or "gangs." But the same chaotic condition which existed with the handy man is still found in the shops where a thousand and one different jobs may be required of any one man. A still further division of labor is required. The individual must be responsible for the prevention of interruptions in special phases of the maintenance function.

From whom may best results be expected; the man who works on electric motors only, who knows every motor in the plant, its load, speed, starting and operating conditions; who realizes that his work is budgeted, that last month's motor maintenance cost so much, and that he was in a large part responsible for this figure, or the man who has to fix a motor one hour, repair telephones the next, and then perhaps to service a truck battery? The former can't "pass the buck" and if he doesn't do the job right this time, he will have that much more to do the next time.

Individual responsibility can be assigned for any group of machines, equipment, or services. A chart analysis of every item coming under the maintenance department may not be easy to prepare, but is a liberal education for him who completes one. Take for instance a specific service in the pipe shop, the steam heating system. Make one good man responsible for its functions at all times; then watch how complaints regarding all annoying disturbances fall off.

To carry out maintenance for present day demands, a complete knowledge of what is to be done is necessary. Knowing this the work can be divided among the men and an assignment of individual responsibility made. Means must then be found for obtaining costs from which may be determined incentives for successful execution and individual efficiencies.

Such a plan is best prepared by the engineering department; for purpose of analysis, division of functions, and adaptability to changing conditions, a system of charts works well. The accompanying function chart shows the ten main divisions of all maintenance in one plant, with subheads carrying shop order or cost account



number which always remains the same. The number of subdivisions can be changed as desired. For instance, the division for buildings may be divided into building proper, floors, and roofs, or may be enlarged by treating separately foundations and walls or any other item.

Using such a chart for all trades, each foreman should be asked to aid in segregating the items with which he is concerned. On buildings, under roofs, the carpenters are responsible for some of the maintenance, but so are the millwrights, the tinsmiths, and the laborers. How is the responsibility divided? The work done by each division can be segregated on that division's chart. Such an analysis is carried through until a separate chart for each trade is made up.

With this chart, each foreman can analyze the work coming under his department. Is daily, weekly, or monthly inspection needed, where may trouble be expected, what attention is required? These questions should be developed with the idea of doing away with the old belief that maintenance and repair are synonymous, and to instill the thought that maintenance is a preventive which eliminates break-downs and repairs.

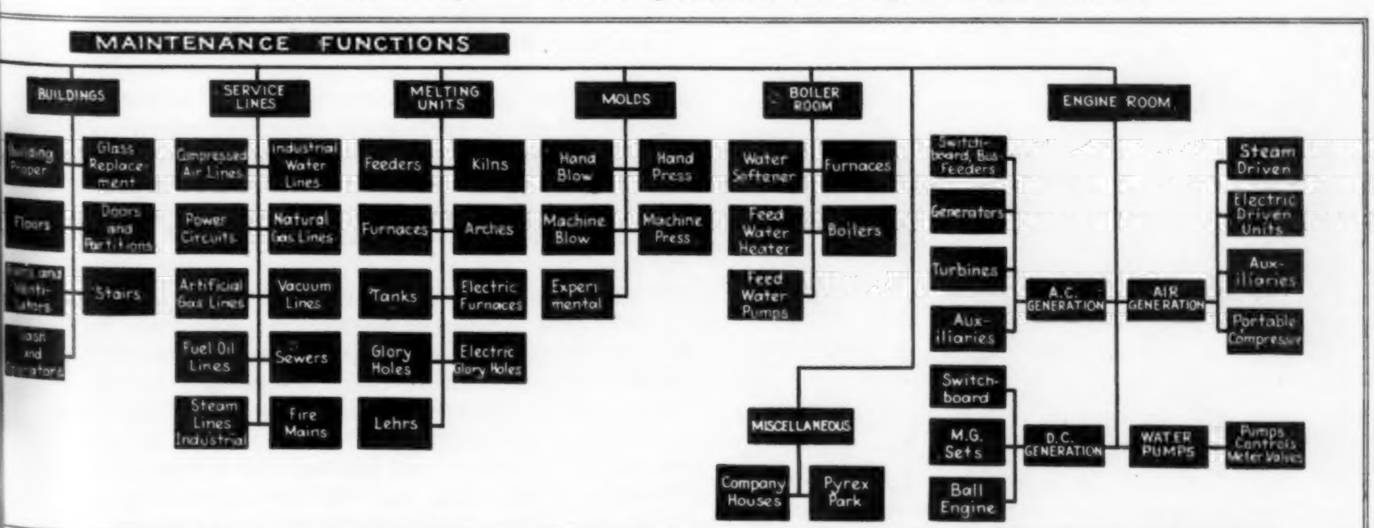
The next step is to determine how costs should be obtained. Actual costs originate largely in the department doing the work and the person to whom they have greatest direct value is the foreman who is told that to assume the same position as that of an individual in business for himself. He is responsible not only for running his shop, but for running it successfully. Production demands that he not only furnishes certain services, but that they are furnished efficiently. Without some means of measure he does not know what he has accomplished. A business man generally assembles his own costs and a foreman should therefore do the same. No one is in a better position to judge whether he is getting a return for the expenditure. He has a group of men, he knows their hours and wage rate, the material used, and the jobs involved. He also can judge whether the work is correctly done. Putting down the actual figures at the end of each day or week he gets a new perspective of accomplishments or failures in his department, whereas monthly statements from a cost department mean little or nothing to him. Mistakes in time, rates, quantities, and unit costs can be caught at their source if all tickets pass through his hands.

Next, individual analyses of each mechanic is necessary, and should be matched with each item on the foreman's chart. Who can best care for one or more particular items? How much can a man do without being overtaxed and forced to neglect any of his duties? For such decisions the experience of the foreman should be drawn upon and, after careful consideration, each job should be delegated to a particular man. Trial of men and frequent checking of costs will show needed changes and by shifting men occasionally individual efficiencies can be obtained. One man may have charge of the heating system, another gas lines and burners, and so on. Some items may be too large for one man, others may be so small that several may be assigned to one man.

Last, but by no means least, consideration must be given to incentive; one great incentive is given every man in the department. He is no longer just an electrician, a pipe fitter, or a carpenter; he has a definite place in the organization, his accomplishment is recorded every month. Another incentive must be added through his pocket book. The system provides for this. A man's activities can be reduced to dollars and cents for any period for any unit. Reductions in cost should mean a bonus to the one responsible. If half of the saving is given to the man, the management makes an equal or greater saving, for reduction in maintenance by preventive measures implies smaller production losses, longer life of equipment, and reduced waste.

A system of preventive maintenance as outlined cannot be planned and executed over night, but once in operation it improves with time. Some of the items considered of great importance at the start may be found to be of secondary value, others may have been entirely overlooked or may deserve greater attention than originally thought. The company will gain through increased production, reduced maintenance, less waste, longer machine life, and better satisfied employees. The foreman becomes more valuable because he is forced to develop himself along new lines; with petty details placed on the shoulders of the individual workmen he is able to manage his shop more efficiently.

Maintenance in the plant of the Corning Glass Works is arranged in ten main divisions



By H. P. DUTTON

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Control ACCOUNTING Under the Code

CERTAINLY, rules of thumb are not going to serve the accountant or the executive of the future as they have in the past. No hoary and time-hallowed 10 per cent is going to suffice as a depreciation allowance in an industry of as swift change as are many branches of the chemical industry. The executive who expects to profit by the period of unexampled chemical development which many believe are just ahead, and at the same time to avoid the more serious of the mistakes inevitable in such a period of development, must think of his business as an equation of variables which obey laws that can and must be determined with greater or less accuracy.

Are you ready for the recovery? The machinery of control is at hand. Well planned systems really control, today, as they did not do ten or even five years ago.

It is undoubtedly the hope of many that the National Industrial Recovery Act program will make of the trade association a wall behind which the inefficient and the high-cost firms may shelter themselves. The published statements of General Johnson and the Administration should by this time have made it clear that the purpose is not to shelter the incompetent but to restrain the chiseler and the unscrupulous. Certain it is that any immunity from the laws of competitive efficiency and cost obtained in this way will be short-lived. The history of previous major recessions support the belief that the uphill period after the turn is always a keenly competitive period, in which real profits must be earned by unusual effort or unusually strong position. There is nothing in the present economic situation to indicate that, in the large view, we face any other prospect today.

The Recovery Act is not the only factor which makes it seem likely that business in the next ten years will differ from the business to which we have become accustomed during the past ten. As this is written, Japan is in a process of conquest and consolidation which, if it is successful, is likely to transfer the greater part of the Orient to a new industrial and economic leadership. Tariff barriers between this country and others are high and there is little immediate prospect of their being substantially lowered. The disturbed state of the world, makes a retreat into national economic self-sufficiency and isolation more probable than one of vigorous expansion of foreign trade, until a more stable equilibrium shall have been reached among the forces now loose in the economic world. Such a policy means that new markets must be found rather by increasing productivity and the capacity of existing consumers to buy than by turning to the potential foreign markets which looked so inexhaustible even four short years ago.

This shift in the general picture in turn means several specific things to the manufacturer and business man. It means opportunity to the inventor and developer of new products which will create new markets or of substitutes which will fill an existing need better or more cheaply.

The shift also means that such new products will continue to displace old ones in the market. The manufacturer who would meet the keen competition which is likely to characterize the decade ahead cannot afford to gamble when he can know the facts. He cannot afford to neglect the economies which seemed so trivial when business was plentiful. Business will be plentiful again, but the history of past depressions indicates that several years are usually required for full recovery. The toboggan is steep, the climb back is slow.

All this in turn signifies the need of a closer, more flexible and intelligent control of operations in the future than the average executive has usually considered necessary in the past. In the days when business men did not bother much with figures but relied on drive and imagination for results, the accountant played a secondary and routine rôle in management. Accounting had been, since the days of the Egyptians, primarily a record of obligations and contracts, and

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the accountant was a man who could keep this record accurately and verify it by double-entry.

It took the engineer, with a mind trained to think in terms of formulas, to see the full possibilities of accounting as a means of control. The early accountant was more concerned with balancing his burden accounts than he was with contributing to the settlement of policy questions which were at best unreal and far away to him.

The engineer and the modern comptroller, trained to regard a business as an inter-relation of moving forces, have carried control accounting a long way. The business man has available to meet the new needs, a new instrument of precision and power.

ONE of the great advances of the last decade has been the development of more accurate methods of accounting for fixed expense. ("Profit Engineering," by C. E. Knoeppel, contains a clear exposition of this subject in detail.)

Not all expenses are exactly proportional to volume or rigidly fixed. But all expenses of any business, the most complex manufacturing operations as well as the simplest retail store, can, by careful analysis of their nature and by simple mathematical methods (see "A Technique for the Chief Executive" by John H. Williams in the *Bulletin of the Taylor Society*, April, 1922) be broken down into a portion which varies with volume and a portion which tends to remain constant irrespective of volume. Every change of price of raw materials, every salary raise, will of course disturb this relationship, but the disturbance can easily be corrected for.

This analysis of expense might almost be called the *Magna Charta* of modern accounting control of business, for out of it grew the flexible budget, the first budget which could be relied upon to work. With the old budgets, constructed by estimating expenses, rents, salaries and all, as percentages on an optimistic estimate of sales, the operating organization made a splendid showing when sales were good, and fell down terrifically when they were not.

No wonder few executives seriously considered, or long continued the plan if they did, the possibility of paying executives on a profit-producing basis. The new basis of accounting makes it quite practicable to pay any executive, from president down to foreman or supervisor, on the basis of a comparison of budgeted with his actual costs.

Another current of thought and development, however, was necessary to bring the modern methods of control accounting to full effectiveness. This was the idea of cost standards.

It was a typical experience for the early industrial engineer to find, when he commenced work in a business, an almost complete lack of blueprints, formulas, or any other forms of standard procedure. Formulas used to be the trade secrets of highly paid superintendents or foremen who often mixed their recipes as a housewife did hers, by feel rather than by measurement. Each lot was a little different from the one before it, not only in composition but in order of processes and consequently in labor and other costs. There being no clear conception of the often staggering cost of set-up and similar charges in small lots, there was little attempt to standardize the product or control the size of lots.

What the chemist has accomplished in the way of standardizing and controlling the composition of materials, the industrial engineer has been doing in the labor field. The time and motion analyst has taken the clumsy process on the poorly planned operation apart and put it together again, often reducing the cost of the process a third or more. And once he has found the best way, he has insured its retention, until a better way was found, by written records and by teaching.

This research to find and establish better methods, to substitute known quantities for uncertainties in the business equation, was not undertaken in order that we might have better cost systems. The cost reductions secured by better layout, by the substitution of orderly flow production of unsystematic passage through disconnected departments—these things were their own justification. Modern material handling, the idea of systematic maintenance, and the theory of a labor relation based on facts instead of on emotion and prejudice are all outgrowths of this work of industrial research.

This study was not, we repeat, made to establish cost systems. But the conditions and controls which it established laid the foundations on which modern accounting for control are based. Budgets mean little in an organization in which responsibilities are so loosely fixed that a showing can be made by a supervisor or an engineer clever enough to shift part of his costs into "indirect" which is charged against another department. Workable budgets had to wait the groundwork of standardization and control. Once that foundation was thoroughly and carefully laid, the budget has become a tool of unsuspected force and scope.

THE factory manager's office keeps its operation records not only in terms of time but of labor cost. It also has available detailed departmental budgets. (Only those expenses controlled by the department are included in the department budget; the others will appear in the factory manager's budget). The sum of those expenses controllable by the department, but not directly related to volume, will constitute the expense budget for which the department head is held accountable. The total standard labor and material cost of the authorized production, set the standard of direct cost which he is expected to meet. Between the two (his expense budget being, of course, calculated for different levels of production which may change the expense constants), the factory manager has a measure of departmental performance which is as fair and accurate at 10 per cent of capacity as at full capacity. The foreman himself, also has a definite goal by which to judge his own results and find his department's weaknesses. Cost control thus becomes the basis of a reasonable disciplinary control, for the idea of standards may be, and is, applied to workmen as well as to department heads. In each case, whether for workman or general manager, the task is set in terms of the factors for which the individual is responsible.

Direct labor in many modern plants may account for less than 10 per cent of the product cost. It was natural that managers should not long confine their attention to leakage at the spigot of direct labor costs, while the

bunghole of selling and general expense was open and running.

Precisely the same principles of control, by determining the best method by research and measurement and standardizing that method, have in recent years been applied to the control of sales and administrative expenses and results.

We are finding that even research should be controlled. One company found, for example, that it was spending large amounts of money in the development of new products and selling ideas, for many of which the possible market offered no prospect of justifying the expense. It organized a merchandising committee. Now the salesman, before he can get his latest bright idea into production, must go before the committee and present and defend not only the idea, but his estimate of the possible market for it. The committee then estimates required investment, and authorizes a fairly specific and definitely limited program of development and experimentation in case prospects justify it.

THE budget was made workable by the development and control of cost standards. A corollary of the budget is the use of standard c sts. There is still some question as to when a standard cost is not a standard cost, but without going into fine points, of interest only to the practicing accountant, the rapid swing toward the use of some system of estimated or predetermined cost standards cannot be neglected in a survey such as this.

Any system other than the historical would have been impossible when there were no defined procedures or responsibilities. But as we got at the problem of measuring labor performance accurately, and in elements small enough to permit of recombination in formulas that really fitted the facts, the idea gained ground: Why not work to what the job ought to cost, and short-circuit all this laborious and relatively ineffective post-mortem of the historical cost sheet?

In the modern standard cost system, labor and material costs are determined by a careful engineering study of required quantities and of prices likely to prevail. Quantities and unit costs are kept separate throughout, so that a rise in the price of crude materials or in the market rate for unskilled labor wil not destroy the validity of the cost comparison.

Burden costs may be estimated in various ways, one of the commonest being to budget the expected expenses for the period and apply this expense at a unit rate to the total expected production of the period. Here again, variable factors are kept separate and shown as variances of various types, so that a fluctuation or failure to earn burden, due to disappointment with sales estimates, will be shown separately from an increase of actual over estimated expense for the period.

Having established these standard costs for the article, it is no longer necessary to record every order on a cost sheet. We are interested only in the variances from standard, and what caused them. Once the standards are established, it is evident that a standard cost system is economical of both executive and of clerical expenses, and in some cases the expenses of the cost department have been substantially reduced by the adoption of a standard cost system.

We have arrived at a budget control, based on cost standards which represent the results which ought to be secured instead of those which in the past happen to have been secured.

In the field of price determination, the development of modern theories for the treatment of expense are bringing the accountant toward the point of view of the "practical" executive, which the accountant used to decry. When volume went down, unit costs under the older theories of accounting went up, as indeed they do in fact. But any practical executive or any accountant of the modern type knows that, when volume of sales goes down, the last thing to do in most cases is to increase the selling price in an attempt to secure costs. The producer who believes himself strong enough to meet the retaliatory price cutting inevitable in such a case, is more likely to reduce than to increase his prices in the attempt to secure the increased volume which will show a profit or at least reduce the loss. But in a business with a relatively inflexible demand, there is no alternative when one secures business by price cutting, but for all to follow. In the end the volume is the same, while the loss has been increased. For this dilemma cost accounting is not an answer, although it may, by showing the uninformed their true costs, prevent the price wars that start from ignorance. There are two possible answers. The one is warfare until the weaker firms are eliminated and the equilibrium is re-established. The other is the type of self-regulation being proposed by President Roosevelt.

While a good cost system will not for the individual firm supply the protection hoped for from the Recovery program, it will supply the clear light needed to avoid stumbling into unsuspected pitfalls.

MANY chemical industries furnish examples of one of the most difficult of accounting problems, that of byproduct costs. Crude oil enters the process and is broken up into many products. From time to time a new one emerges, and it has not been uncommon for the casual byproduct to grow in demand until it, and not the original product, has become the principal object of operations. How shall the expenses common to both or several products be prorated to give a true cost?

This is not a question which admits of a single answer; the answer must of necessity vary with the assumptions made. Various common assumptions are made as the basis of byproduct costing and doubtless serve for the conditions to which they are applied.

The development of budgets has led to a healthy tendency to express situations of this sort not as percentages or unit costs but as total situations, that is, as estimates of the aggregate dollars-and-cents results of a particular plan of action. This, after all, is a more direct and safer method of viewing the facts than by reducing these facts to percentages and then translating them back again. Many knotty byproduct problems can be settled by setting up the facts as to existing equipment and markets in a cost comparison to show the total results of the possible alternatives. In important problems we shall probably in the future see more decisions made on the basis of hypothetical budgets, indicating the probable effect on operating results of the proposals under consideration, and less on the basis of percentage or flat-amount unit costs.

BOOKSHELF

Chemico-Economic History

CHEMICAL ECONOMICS. By *Williams Haynes*. Published by D. Van Nostrand Co., New York, 1933. 312 pages. Price, $3.25.
Reviewed by *S. D. Kirkpatrick*.

MR. HAYNES has written a most interesting book. In a sense it is two books for Part One, Economic Foundations, and Part Two, Historical Backgrounds, are separate treatises, related only through their common application to chemical industry. Both are subjects that can and should some day be elaborated at greater length. This the author recognizes in a prefatory note in which he expresses the wish that he may "find the time to write a real history of chemicals in America." This reviewer joins in that wish, for he holds that never before has the story of American chemical industry been written in such a readable and fascinating manner. The seven chapters that begin with an account of industrial evolution in England and on the Continent, and trace through American progress to prospective developments in the chemical future are all too brief.

The reader approaches this interesting history by way of five chapters concerned with economic principles, largely as applied to the distribution of chemicals. The economics of chemical production receive general but perhaps inadequate treatment in the introduction and later in Chapter II. The chemical engineer will be gratified to learn that "with the discovery of the laws of mass action and the phase rule . . . the manufacture of chemicals ceased to be an art and became a science." But this quotation is not a fair criterion of the book as a whole, for it is purposely non-technical, descriptive and qualitative rather than analytical and quantitative. The nearest approach is probably in Chapter V on Chemical Distribution. Here the author, with some temerity, attacks the economic unsoundness of certain methods and practices that have grown up in chemical industry. In his reference to the cost of freight equalization he is unfortunate, however, in citing the figure 31.8 per cent as representing the proportion of the total sales of heavy chemicals chargeable to this uneconomic outlay. The figure is incorrectly credited to C. M. Bigelow, whose name merely happens to appear on the same page of *Chem. & Met.'s* January, 1932, issue, from which this figure was taken. This reviewer happens to know that it is also incorrect to infer that this figure is applicable to all heavy chemicals for, as our caption clearly pointed out, it was merely a breakdown of the selling expenses of a single large chemical company.

The careful reader of the technical press will also recognize familiar material in other chapters in Part One, for some of Mr. Haynes' own articles in *Chemical Markets* as well as others from current periodicals have occasionally been drawn upon as source material. It is unfortunate that credit cannot always be given to these contemporaries.

Attractively printed and bound, "Chemical Economics" is illustrated in the modern manner with a series of striking and artistic photographs, thumb-nail portraits of several scores of prominent chemists and industrialists and some informative charts. A number of typographical errors should be corrected in the next edition, particularly one on page 132, where the memory of a noble Englishman, William Gossage, is libeled in the statement that he was a "profligate" chemical inventor. The late H. H. Dow is credited with effecting "economics" on page 47. The acquisition of A. Klipstein by du-Pont instead of Cyanamid is noted on page 267. Elsewhere the book treats of such chemicals as "salycylic" and "barbaturic" acids, the application of "hot fire" and other examples of slightly unorthodox technology.

Despite such trivial criticism, this book will serve an important function in chemical industry. It will be of real assistance to the student and to the non-technical salesman and executive who would learn the business and historical side of chemical industry. There is still a place, however, for a book on chemical engineering economics that will confine itself to the careful study of the feasibility of processes and products, economic balance of operations and costs, and other similar and quantitative considerations.

Cellulose's Day in the Sun

THE METHODS OF CELLULOSE CHEMISTRY. By *Charles Doree*. Published by D. Van Nostrand Co., Inc., New York. 499 pages. Price, $7.
Reviewed by *D. F. Othmer*.

WITH THE SUN rising higher and higher in the sky of this "Day of Cellulose," the number of scientists and engineers throughout the world who are working on the industrial development and utilization of the many cellulose forms is greatly increasing.

This volume is the first book devoted to the experimental methods and technique of these investigators; and has for its object the placing before the reader of all of the known tools for work in this field. It is intended as a synopsis of the best published methods of attack of the problems of cellulose chemistry, and well covers the broad field of publications.

The book is divided into three parts: Normal Cellulose, Synthetic Derivatives of Cellulose, and The Investigation of the Compound Celluloses. The appendix includes, besides various tabular physical relations, a list of books on cellulose and wood.

The author is an authority and an outstanding contributor to the science of cellulose chemistry. His presentation is compiled from many sources and is particularly valuable because each method is critically compared to others for accomplishing the same purpose, and has the relative merits expertly discussed. This book is highly recommended for those in any way connected with the manufacture, processing, or testing of cellulose products, paper, plastics, lacquers, film, rayon, and others.

Interionic Theory

THE CONDUCTIVITY OF SOLUTIONS. By *Cecil W. Davies*. Published by John Wiley & Sons, New York. 281 pages; 32 figures; many tables. Price, $4.
By *Frederick E. Schmitt, Jr.*

WITHIN THE PAST six years several great contributions to the theoretical knowledge of conductivity in solutions have been made. Practical results of conductivity measurements in the past have failed to be explainable on the basis of the original Arrhenius theory of complete dissociation; there has always existed the anomaly of the term "degree of dissociation." But the theory of interionic attraction, put forward first by Milner in 1912, and extended into workable form by Debye and Hückel in 1927, offers a rational analysis of, and solution to, these anomalous results. The newer interionic theory supplements, but does not replace, the original view of complete dissociation as taken by Arrhenius. While the two supplementary theories by no means supply a complete solution to problems of electrolytic action, since some of the variable factors must be simplified or omitted entirely to bring the resultant analysis within the range of present-day mathematical tools, a large field for extension of both theoretical and practical knowledge about electrolytic solutions has been opened.

Professor Davies' book, in its first edition, was concerned with developing the treatment of conductivity problems and data into a unified whole in the light of the new interionic attraction theory and its relation to the classical ideas of Arrhenius. In this, the second edition, the same comprehensive unit survey of the field is made. The field

is, however, broad; ranging from a discussion of the conductivity-viscosity relations and conductivities in mixed solvents to an application of the modern theory to polvolysis and the behavior of complex ions. This catholic discussion is both very necessary and highly commendable, for all reactions of electrolytes and ionic phenomena in general depend upon mobility and therefore conductivity. Revision of the material contained in the first edition, and the addition of much new matter, has been made necessary by the great volume of work on this subject appearing since the first edition was published. Two new chapters have been added dealing with the practical applications of conductivity methods.

Recent German Publications

GRUNDLAGEN DES ELEKTRISCHEN SCHMELZOFENS. By *Johannes Wotschke*. Verlag von Wilhelm Knapp, Halle, Germany. 505 pages. Price, 42 Rm.

ALL FUNDAMENTAL principles involved in electric furnace operations have been discussed from a theoretical, practical, and economic point of view. The book is divided into three main parts, the first of which is largely devoted to the laws of electricity involved and the electrical apparatus utilized in the construction. In the second part the various types of electric furnaces and their construction have been taken up. The third section treats the smelting process and contains chapters on energy consumption, analysis of losses, and heat and material balances. A large number of illustrations and a bibliography have been included.

DER CHEMIE-INGENIEUR. Vol. I. By *A. Eucken* and *M. Jakob*. Akademische. Verlagsgesellschaft m.b.H., Leipzig, Germany. Part I. 539 pages. Price, 54 M. Part II. 385 pages. Price, 38 M.

MODERN CHEMICAL TECHNOLOGY is making increased demand for a quantitative understanding of the physical principles upon which successful application of the various processes is based. This comprehensive handbook, written to meet this demand, should do much to supplement that side of the chemical engineer's education. Part I deals with flow of liquids and heat transfer; Part II treats crushing and grinding, classification, screening, filtration, centrifuging, and precipitation and settling of dust.

TERNÄRE SYSTEME. By *Dr. G. Masing*. Akademische Verlagsgesellschaft m.b.H., Leipzig, Germany. 164 pages. Price, RM. 9.60.

KNOWLEDGE of the ternary systems is becoming increasingly important in the systematic study of alloys. Whereas the binary alloys have received much attention, the more complicated ternary systems have not been fully explored, and the literature on this subject is scant and fragmentary. To correct this situation, the author has endeavored to fill some of the larger gaps, and to present a foundation upon which the practical metallurgist, as well as the theorist, may build. His thorough knowledge of the subject at hand insures the success of his undertaking.

CHEMISCHER HANDATLAS. By *W. W. Meissner*. Verlag Georg Westermann, Berlin, Germany. 77 pages. Price, 38 M.

USING THE NATURAL system of the elements and the Rutherford-Bohr atom model as a basis the author has given a graphic presentation of the chemical elements and their compounds. These have been arranged in 60 multicolored charts, with symbolic selection of colors to permit rapid assimilation and interpretation of the data.

GOVERNMENT PUBLICATIONS

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Fuel Oils. Bureau of Standards, Commercial Standard CS12-33 (Second Edition); 5 cents.

Paints, Varnishes and Containers. Bureau of Standards, Simplified Practice Recommendation R144-32; 5 cents.

Glass Containers for Preserves, Jellies and Apple Butter. Bureau of Standards, Simplified Practice Recommendation R91-32; 5 cents.

Cross-Blocking Sugar Beets by Machine, by E. M. Mervine and A. W. Skuderna. Department of Agriculture Leaflet No. 97; 5 cents.

Commercial Storage of Fruits, Vegetables, and Florists' Stocks, by Dean H. Rose and others. Department of Agriculture, Circular No. 278; 5 cents.

Effects of Time of Planting and of Fertilizer Mixtures on the Curly-Top Resistant Sugar-Beet Variety U. S. No. 1 in Idaho, by A. W. Skuderna and others. Department of Agriculture, Circular 273; 5 cents.

Grades of Peat and Muck for Soil Improvement, by A. P. Dachnowski-Stokes. Department of Agriculture Circular 290; 5 cents.

Computed Duties and Equivalent Ad Valorem Rates on Imports Into the United States From Principal Countries 1929 and 1931. U. S. Tariff Commission, unnumbered Miscellaneous Series; 5 cents.

Methods of Valuation. U. S. Tariff Commission, Report No. 70, Second Series; 10 cents.

The Health of Workers in Dusty Trades, by Lewis R. Thompson and others. Public Health Service Bulletin 208; 5 cents.

Labor Productivity in the Automobile Tire Industry, by Boris Stern. Bureau of Labor Statistics, Bulletin 585; 10 cents.

The Bleaching Clays, by P. G. Nutting. U. S. Geological Survey, Circular 3; mimeographed. Deals with fullers earth and other types of clays used industrially for bleaching.

Federal Specifications. New or revised specifications of the Federal Specifications Board on: Aluminum-alloy (aluminum-copper-magnesium-manganese); bars, rods, shapes, and wire, QQ-A-351; aluminum-alloy (aluminum-copper-magnesium-manganese), plates and sheets, QQ-A-353; Aluminum-alloy (aluminum-manganese), bars, rods, shapes, and wire, QQ-A-356; Asphalt, (for) Built-Up roofing, waterproofing, and damp-proofing, SS-A-666; Cement, bituminous, plastic, SS-C-153; Roofing and shingles, asphalt-prepared, mineral-surfaced, SS-R-521 Tubing, aluminum, round, seamless, WW-T-783; Aluminum-alloy (aluminum-manganese), plates and sheets, QQ-A-359; Ferrosilicon, QQ-F-181; Aluminum, bars, rods, shapes, and wire, QQ-A-411; Polish, stove, P-P-576; Brick, silica, HH-B-681; Charcoal, LLL-C-251; Turpentine, (for) paint, type II, LLL-T-792; Turpentine, (for) paint, LLL-T-791a; Bars, reinforcement, concrete, QQ-B-71; Steel, structural, (for) bridges, QQ-S-711. The above specifications are available from the Bureau of Supplies and Accounts, Navy Department.

Safety at Petroleum Cracking Plants, by R. L. Marek. Bureau of Mines, Technical Paper 551; 10 cents.

Viscosity of Natural Gas, by W. B. Berwald and T. W. Johnson. Bureau of Mines, Technical Paper 555; 5 cents.

Helium, by Andrew Stewart. Bureau of Mines, Information Circular 6745; mimeographed.

A Study of the Properties of Texas-New Mexico Polyhalite Pertaining to the Extraction of Potash—VII, Effect of particle size, sodium chloride concentration, and temperature upon hot extraction by a multistage process, by J. E. Conley and F. Fraas. Bureau of Mines, Report of Investigations 3210; mimeographed.

Foreign Commerce and Navigation of the United States for the Calendar Year 1932. Department of Commerce, unnumbered volume; $2.00 (Buckram), 590 pages. Gives import and export statistics for the United States.

Cement and Concrete Products. Bureau of the Census, Census of Manufactures, 1931; 5 cents.

Cellulose Plastic Products. Bureau of the Census; mimeographed. Issued monthly, giving statistics of production and shipments, compared with preceding months. Formerly entitled "Pyroxylin Products; Rods, Sheets and Tubes."

Quarterly Gypsum Reports. Bureau of Mines; mimeographed. Gives statistics on gypsum and comparison with preceding quarter. Fourth quarterly report gives annual figures.

Mineral Production Statistics for 1931—Separate pamphlet from the Bureau of Mines on: Cement, by B. W. Bagley, 5 cents.

Mineral Production Statistics for 1932—preliminary mimeographed statements from Bureau of Mines on: Mica; natural gas; petroleum, petroleum products, and natural gasoline.

Rock-Salt Mines; United States; Accident-Prevention Record for the Five Year Period 1928 to 1932. Bureau of Mines, H.S.S. 92; mimeographed.

Public Health Reports. Vol. 48, No. 32. Aug. 11, 1933. Government Printing Office, Washington, D. C. 5 cents. The issue contains a study of the hygienic position of zinc, made by C. K. Drinker and L. T. Fairhall, of Harvard School of Public Health, in which the following facts are revealed: The limit of five parts per million of zinc in drinking water, set by the Public Health Service in 1925, should be increased or done away with all together, as many times this quantity may be taken without harmful effect. Foods or beverages, with the exception of simple or chlorinated drinking water, should not be stored in zinc-lined or galvanized containers. A single industrial condition arises from zinc, and this condition is not produced by zinc alone. This is the "zinc chill" better known as metal fume fever. The different groups of symptoms described as chronic industrial zinc poisoning, together with other complex ills which have been ascribed to zinc, may be disregarded, as they are due to contamination by other substances.

PLANT NOTEBOOK

Emergency Remote Control for Gas Engines In Compressor Plants

By F. L. Kallam
Industrial Engineers, Inc.
Los Angeles

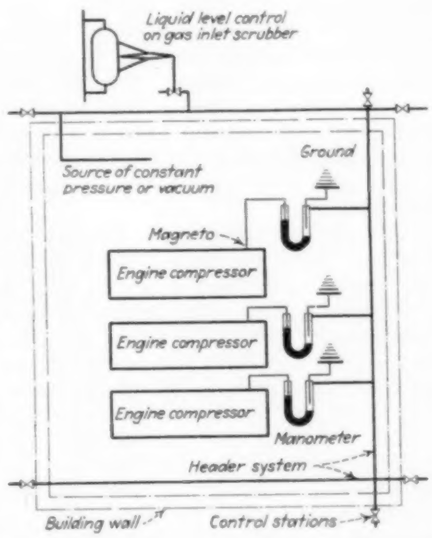
SEVERAL recent events in compressor plant operation have emphasized the need of a universal system for positively shutting down the machines in cases of emergency.

The first of these events resulted from earthquake disturbances, which caused the absorbers in a certain plant to be shifted sufficiently to break the gas connections. This necessitated an immediate shut-down of the compressors which was attempted in the conventional manner by closing a valve in the main fuel-supply line outside the building. After closing this valve the operator had sufficient time to return inside the building and close the fuel throttle on each individual engine, all of which were still in operation. The interval between the closing of the outside master fuel valve and that on the last engine could not have been less than 2 minutes.

The second event followed shortly after the first, and was the rupture of a compressor head caused by the presence of an excessive quantity of liquid in the cylinder. Again the master fuel-supply valve was immediately closed, but after an interval estimated to be well over a minute, an explosion occurred, which developed into the usual disastrous fire. Evidence is at hand that at the time of the explosion, the engines were still running.

Grounding Ignition the Solution

From these two instances one conclusion can be drawn; that because of the storage capacity of the lines, shutting off the main fuel supply to the engines in a compressor plant does not shut the machines down quickly enough to prevent possible explosions. As long as the engines continue to operate, the ignition continues to function, and hence the hazard from explosion is not removed until all the engines are motionless. During emergencies when gas or gasoline vapors are released in the engine room, the continuation of engine operation will unfailingly ignite the vapors. Safety lies in immediate stoppage of the machines, through making the ignition systems inoperative, as by grounding.



Pressure or vacuum-operated remote control for grounding gas engine magnetos

Tests of this nature were made on a number of different types of machine. Several methods for shorting the ignition on all the machines in a compressor plant from various remote control stations were tried. Systems involving the tapping of the high-tension cables of the secondary windings of the magnetos apparently are out of the question because of difficulties in maintenance, interference between magnetos, and the condenser effect of the long high-tension cable leads which causes misfiring.

From a practical standpoint the magnetos should be shorted on the low-tension circuit side, but a number of such installations, wired to control points outside the plant buildings, have been abandoned because of the trouble encountered in maintaining the system operable.

The accompanying drawing presents a different type of system for grounding all magnetos simultaneously by remote control. A 1-in. header running the length of the compressor plant is held under constant air pressure or vacuum as desired. At each engine a $\frac{1}{4}$-in. line takes off from the header and connects to one leg of a specially insulated manometer containing mercury. The manometer is mounted adjacent to the magneto, so that the length of cable from the latter's low-tension side can be readily connected to one terminal of the manometer. The second terminal of the manometer is connected to ground. From the 1-in. main control header, the required number of laterals are run to the desired emergency stations, which can be located at points within the building or without, or at other points in the plant. These laterals terminate in quick-opening valves at the various stations and, if desired, one of them may be operated by the action of a float on the scrubber through which the gas passes on the way to the compressors. Should the liquid in this scrubber accumulate beyond a safe operating point, the entire plant would automatically be shut down from this station.

How the System Works

In normal operation, the mercury in the manometers is held in contact with one terminal by either the constant pressure or vacuum within the main header. This terminal may be either that connected to the magneto or to ground. To operate the system, and place the engines out of commission, it is only necessary to open the valve at any one of the remote control stations, which results in the header and manometers being subjected to atmospheric pressure. This condition at once balances the mercury in both legs of the manometer, and thus contacts both terminals. This provides a direct circuit from the magneto to ground, so that danger of ignition from this source of explosive gas mixtures is entirely eliminated.

This type of system combines the advantages of extreme simplicity of construction, compactness, and speedy and unfailing operation, together with low cost of installation and maintenance. In the interest of "Safety Always" it cannot be disregarded.

NEW EQUIPMENT

Temperature-Sensitive Foil

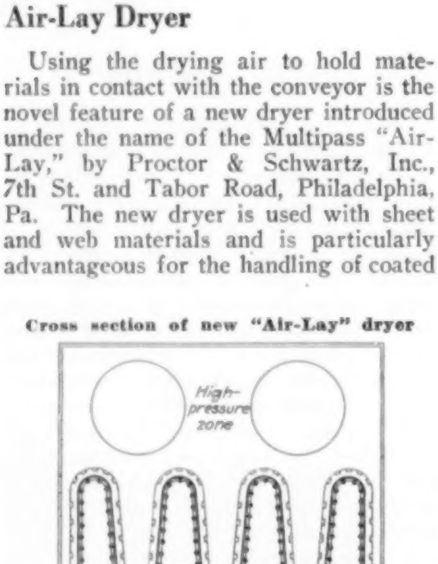
"Signalotherm" is the name of a new temperature-sensitive chemical foil recently developed by Szabo & Beer, 15 East 16th St., New York City. This foil may be attached by gluing or cementing to any surface, the temperature of which is to be operated within certain limits. Should the temperature go above the desired limit, the strip of foil will change color, returning to its original color upon cooling. The foil is said to be of unlimited life and for it are claimed the further advantages of certain operation, conspicuous optical action, unbreakability, low cost and ready application.

These foils are manufactured at present for ratings of 55, 65, and 75 deg. C., while other foils for higher temperatures, such as 85, 95, 130, 150, 200, and 300 deg. C., are in course of preparation.

Air-Lay Dryer

Using the drying air to hold materials in contact with the conveyor is the novel feature of a new dryer introduced under the name of the Multipass "Air-Lay," by Proctor & Schwartz, Inc., 7th St. and Tabor Road, Philadelphia, Pa. The new dryer is used with sheet and web materials and is particularly advantageous for the handling of coated materials where one side must never come in contact with the supporting conveyor.

Cross section of new "Air-Lay" dryer



The principle of the new conveying mechanism will be clear from the accompanying drawing. The air introduced from the high pressure zone through numerous nozzles blows against the material, holding it against the conveyor as shown. This air then travels sideways across the material, passes through heating coils, and is recirculated. Part of the air is continuously exhausted to maintain constant humidity.

Among the advantages claimed for the new dryer are these: Nothing but air comes in contact with one side of the material; this is accomplished in a minimum of space by doubling the conveyor back and forth within the drying cabinet; as a consequence of the methods used, the mechanism is extremely simple. Among other advantages may be mentioned the fact that the material is held flat while drying, that there is no tension and that uniform distribution of the air over all the material results.

Sensitive Mercury Detector

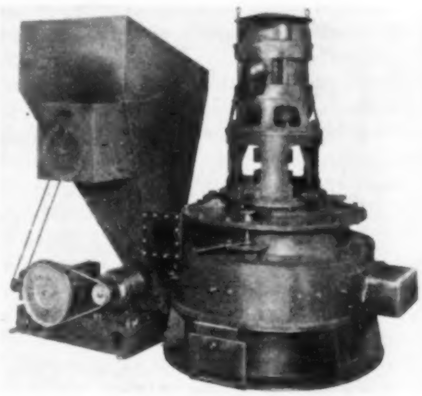
Detection of as little as one part of mercury vapor in 100,000,000 parts of atmosphere is credited to a new device recently developed by the General Electric Co., Schenectady, N. Y. The best previous mercury detector was capable of giving a warning of one part of mercury in 30,000,000 parts of atmosphere. Furthermore, the new detector is much more rapid in operation.

The new device continuously draws in flue gases from the stack of a mercury boiler. After a preliminary treatment to remove impurities, the gases pass through a beam of ultra-violet radiation coming from a mercury light source. The beam is directed toward a quartz-sodium phototube which detects the "shadow" cast by any mercury vapor which may be present. Combined with this device is a mercury-vapor detector of the type previously used in which the vapor sweeps rapidly across a sheet of paper coated with selenium sulphide. Any darkening due to mercury reduces the reflection from the paper and causes a second phototube to operate warning signals. The two are used to check each other.

This company has also announced a new indicator and recorder for smoke density, consisting of a light source and phototube, together with a recording meter.

Air-Separation Pulverizer

A novel principle of air separation is employed in the latest of a new line of air-separation pulverizers developed by the Whiting Corp., Harvey, Ill. The pulverized material remains in the pulverizing chamber until it is fine enough to be withdrawn by a blower built integral with the pulverizer and driven from the pulverizer shaft. This method is said to eliminate the use of exterior separators. A screw feeder driven through a variable speed transmission



New type 30-A Whiting air-separation pulverizer

may be connected to the apparatus for automatic control operation. When hot air is introduced into the pulverizing chamber, water-cooled bearings are provided. These pulverizers are built in three sizes having capacities from 50 lb. to 3,500 lb. per hour.

Equipment Briefs

For aligning pipes to be welded and holding the adjacent ends in the proper relation to each other during tacking, Oster-Williams, Cleveland, Ohio, has developed the new "Bull Dog" pipe-welding clamp which is available in two sizes, one covering the range from 4 to 6 in. pipe diameter and the other from 8 to 12 in. A single lever controls the action of the clamp, making it easy to put on and take off the pipe.

Carbondale Machine Co., Carbondale, Pa., has announced the development of a new automatic CO_2 regenerating system for use in fermentation industries. The new unit reclaims the

gas directly from the fermenters, compressing and liquefying it for storage in drums. Because of its automatic features, the plant does not require frequent inspection or manual adjustment.

Canvas-reinforced Bakelite is used for the frame in a new welding spectacle, Type AA, recently announced by the Linde Air Products Co., 30 East 42d St., New York City. The goggles employ a new high-protective lens and insulating temples. The same company has announced a new all-purpose aluminum welding flux suitable for welding both pure aluminum and its alloys.

Skin protection against occupational dermatitis caused by the action of chemical materials is said to be afforded by three types of protective skin cream produced by Milburn Co., Free Press Bldg., Detroit, Mich. The first is soluble only in water, the second is similar to the first, but with the addition of an antiseptic, and the third is soluble in neither water nor oil, but may be removed by washing with soap.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has brought out a new line of electric-operated fluid valves for handling compressed air and various liquids. The new valves are offered in various styles and sizes ranging from $\frac{3}{16}$ to $\frac{15}{16}$ in. port diameter.

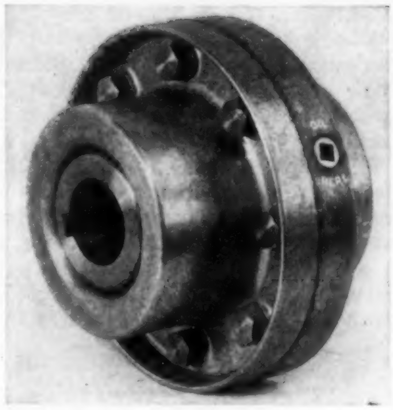
Improvements in two of its line of vibrating screens have been announced by Allis-Chalmers Mfg. Co., Milwaukee, Wis. These include the Style B centrifugal screen available in one-, two- and three-deck models in sizes from 2x6 ft. to 5x14 ft.; and the suspended-type "Aero-Vibe" screen made in single and double-deck models in sizes to 4x8 ft.

Because a certain amount of checking occurs when a hot bottle is transferred to a cold conveyor chain, Link-Belt Co., 910 South Michigan Ave., Chicago, Ill., has developed a new grating-type tray made of copper and mounted on two strands of finished roller chain. As the copper is a better conductor of heat, there is said to be a practical elimination of checking.

For infinite speed adjustment in ranges of from 2:1 to 6:1 and capacities from $\frac{1}{8}$ to $\frac{3}{4}$ hp., Reeves Pulley Co., Columbus, Ind., has brought out its new Type 0000 vertical, inclosed transmission. The new unit is only about 14 in. high and weighs 70 lb.

Light-Duty Couplings

After a conservative three-year test of over 1,000 couplings, the Bartlett-Hayward Co., Baltimore, Md., has announced a new light-duty line of Fast's flexible couplings for the transmission of 2 to 15 hp. per 100 r.p.m. at a maximum speed of 3,600 r.p.m. The novelty in these new couplings consists in the use of die-cast sleeves or casings



New coupling with die-cast sleeve

instead of the forged type previously used, resulting in a considerable reduction in cost. The sleeve is a zinc-base alloy, and the hubs of forged steel. The company has guaranteed these couplings for the life of the connected machine.

Furnace Draft Regulator

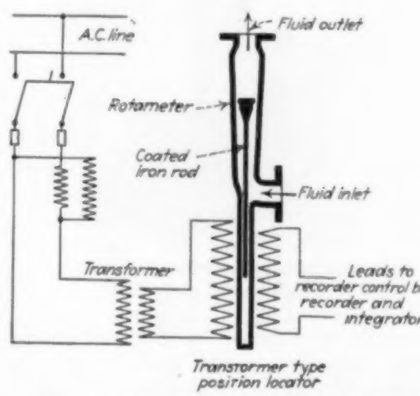
Need for an accurate and reliable means of draft control for average boiler plants, up to 200 hp., is responsible for a new design of hydraulic draft regulator that is being offered by the Carrick Engineering Co., Michigan City, Ind. The new regulator, Type HF1, is similar to earlier designs except for its smaller size. The device consists of a casing containing a floating bell, sealed with oil, which is used to measure the draft changes. Through a system of levers the bell operates a four-way pilot valve which in turn controls the position of a hydraulic power cylinder. The bell and beam are of aluminum and the knife edge of stainless steel, case-hardened to resist wear.

Belt Conveyor Calculators

Harry F. Geist, engineer of the Sportsman's Scientific Service, Aurora, Ill., has designed two circular slide rules which, used together, permit the ready calculation of all information required in the design and specification of belt conveying installations. One of these slide rules is shown in front and back views in the accompanying illustration. With the first of these, Style BW, it is possible to determine the loading and belt width. In addition to the instructions on the rear, the table gives constants for various belt widths and specifications for maximum speed, maximum lump size and capacity for various materials. The second dial, Style BP, permits the determination of maximum and running belt tension (for either horizontal or sloping conveyors) together with the horsepower. Both dials incorporate measures for checking the suitability of assumptions that may have been made in the calculations.

Electric Flow Recorder

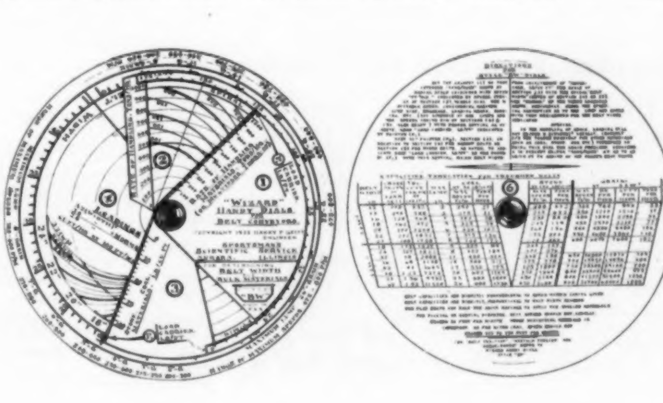
Where flow is to be recorded, integrated or indicated at a distance from the flow-measuring device, Schutte & Koerting Co., Philadelphia, Pa., has introduced a modified form of Rotameter. The Rotameter is a float-type flowmeter employing a small float



Wiring diagram of new electric Rotameter

which rides in a tapered tube at a height dependent on the flow rate. Customarily, the position of the float is noted visually through the transparent walls of the tapered tube. In the electric model, an a.-c. induction coil is used as an electric position indicator, as shown in the accompanying drawing. An iron rod, which may be coated with corrosion-resisting material, is hung

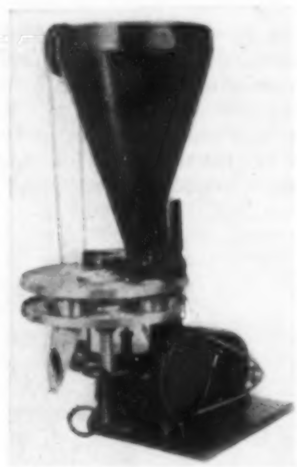
Front and rear of Style BW "Wizard Handy Dial" for belt conveyors



from the float, projecting into a closed well placed below the metering tube. The current through the primary winding induces a current in the secondary winding proportional to the amount of iron within the coil—that is, proportional to the instantaneous flow. The registering instrument is essentially a millivoltmeter and the readings directly proportional to the rate of flow.

Low-Cost Packer

For packaging materials, such as crystals, powders, tablets, and other semi-free and free-flowing materials, Frazier & Son, Belleville, N. J., has developed the new Whiz-Packer shown in the accompanying illustration. The



New packer for semi-free and free-flowing materials

machine is said to have an unusually large capacity range and to be extremely simple in operation. The product is dumped into the conical hopper from which it is removed by four rotating cups. Each cup discharges into a spout which in turn discharges into a bag or other container. Speeds of 10 to 40 packages per minute are said to be quickly available.

Among the advantages claimed are rapid adjustments for accurately varying the discharge, intermittent agitator movement, ease of cleaning, small size and low power consumption.

Magnetic Separator for Liquids

High-intensity magnetic separation for clay slip, glazes, vitreous enamels and other liquids and suspensions is the function of a new separator developed by the Patterson Foundry & Machine Co., East Liverpool, Ohio. The new separator consists of an aluminum trough fitted snugly to the pole faces of magnets hermetically sealed into an aluminum case. Above each pole face is a portable auxiliary magnet that is supported in the aluminum tray. The auxiliary magnets are staggered and so designed that their poles interlock. Their surfaces are corrugated so that each knife edge represents countless individual pole tips.

In operation, the material is fed into the separator and passed over and around the auxiliary magnets. When the device must be cleaned, this is readily accomplished by removing the auxiliary magnets and flushing out the entire tray. Sizes range from 400 to 2,000 gal. per hour capacity with current consumption ranging from 500 to 2,500 watts.

This company has also announced a new line of agitator drives known as "Unipower," employing motorized speed reducers available in both horizontal and vertical types. Sizes range from 40 hp. down to fractional. Several frame types are available and units are supplied complete, requiring no additional bearings or flexible couplings for installation.

MANUFACTURERS' LATEST PUBLICATIONS

Chemicals. Industrial Chemical Sales Co., 230 Park Ave., New York City—24-page booklet entitled "An American Story of Precipitated Chalk," covering production, testing, properties and uses of this material.

Chemicals. Mathieson Alkali Works, 250 Park Ave., New York City—72-page handbook of water works practice entitled "Hypo-Chlorination of Water."

Compressors. Worthington Pump & Machinery Corp., Harrison, N. J.—Publications as follows: L-600-B2, 16 pages on refrigeration compressors; L-611-S6B, 8 pages on horizontal, single-stage compressors; L-622-S1, 6 pages on large, vertical, duplex refrigeration compressors; L-622-S2, 6 pages on small, vertical duplex refrigeration compressors.

Conveying. Fuller Co., Catasauqua, Pa. —Loose-leaf general catalog, 36 pages, covering description and uses of the Fuller-Kinyon system of conveying pulverized materials.

Disintegration. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin 1251—12 pages on milling equipment for distilleries.

Dust Collectors. Pangborn Corp., Hagerstown, Md.—Folder describing construction features of this company's new CH dust collector.

Electrical Equipment. Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.—12 pages on motors, generators, motor generators, speed changers, couplings and torque meters made by this company.

Electrical Equipment. Crouse-Hinds Co., Syracuse, N. Y.—Bulletin 2265—16 pages on Obround Condulets.

Electrical Equipment. Hart Mfg. Co., Hartford, Conn.—Bulletin 10-A—32 pages on remote control switches.

Equipment. Bird Machine Co., South Walpole, Mass.—Leaflet describing the features of this company's save-all system for recovering white water.

Equipment. National Radiator Corp., Cast Products Division, Johnstown, Pa.—Report CP-8—53-page engineering report on the development and tests of an oil emulsion dehydrator made by this company.

Equipment. Patterson Foundry & Machine Co., East Liverpool, Ohio—Form P-206—4 pages describing this company's Unipower agitator.

Hydrometers. C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y. —Leaflet describing an improved line of certified hydrometers made by this company.

Instruments. Brown Instrument Co., Philadelphia, Pa.—Catalog 6702—80 pages on this company's new line of thermometers and pressure gages—indicating, recording and controlling.

Instruments. The Foxboro Co., Foxboro, Mass.—Bulletin 185—40 pages on this company's indicating, recording and controlling pressure instruments.

Instruments. General Electric Co., Schenectady, N. Y.—GEA-1784—8 pages on Type AP-9 portable ammeters, voltmeters and wattmeters.

Level Control. Kieley & Mueller, Inc., 34 West 13th St., New York City—Bulletin C—24 pages on float-type liquid level controllers.

Level Control. Northern Equipment Co., Erie, Pa.—16-page booklet with illustrations, description and specifications of this company's equipment for liquid level control.

Metal Spraying. Metals Coating Co. of America, 495 North 3d St., Philadelphia, Pa.—Bulletins 1201 and 1202—Respectively 8 and 4 pages on the definition, history and properties, etc., of this company's process; and illustrations of metal spraying and sand-blast installations.

Metals and Alloys. Ingersoll Steel & Disc Co., 310 South Michigan Ave., Chicago, Ill.—4 pages on the use of this company's stainless-clad steel.

Piping. Tube-Turns, Inc., 1500 South Shelby St., Louisville, Ky.—Bulletin 404—24-page bulletin and price list on this company's Tube-Turns and other welding fittings.

Power Transmission. Farrel-Birmingham Co., 437 Vulcan St., Buffalo, N. Y.—Bulletin 437—8 pages on this company's Gearflex couplings.

Pumps. Morris Machine Works, Baldwinsville, N. Y.—Bulletin 150—8 pages on double-suction, high-speed centrifugal pumps.

Refractories. Norton Co., Worcester, Mass.—Bulletin describing the use of Crystolon brick for high temperatures.

Separation. Raymond Bros. Impact Pulverizer Co., 1302 North Branch St., Chicago, Ill.—Leaflet describing results attained with this company's air separators.

Testing. Bausch & Lomb Optical Co., Rochester, N. Y.—Leaflet describing testing of glassware with polariscopes, microscopes and thickness gages.

Trucks. Aluminum Co. of America, Pittsburgh, Pa.—65-pages on the use of aluminum for truck bodies, including as a supplement, several construction drawings and bills of material for six types of aluminum body.

Valves. Edward Valve & Mfg. Co., East Chicago, Ind.—Catalog 11, Section L—Data on complete line of Ferac valves in various designs for steam pressures to 250 lb.

Water Equipment. Graver Tank & Mfg. Corp., 332 South Michigan Ave., Chicago, Ill.—Publications as follows: 8 pages on brewery tanks and equipment; 12 pages on distillery tanks and equipment; 12 pages on horizontal and vertical water filters; and 4 pages on elevated steel tanks.

Water Treatment. D. W. Haering & Co., 3408 West Monroe St., Chicago, Ill.—16 pages on this company's water treatment methods for boilers, air conditioning systems, etc.

Weight Control. Hardinge Co., York, Pa. — Bulletin 33B — 4 pages describing the principles of this company's constant weight feeder.

Weight Recording. Streeter-Amet Co., 4101 Ravenswood Ave., Chicago, Ill.—Leaflet reprinting an article on automatic weight recording with this company's equipment.

NEWS OF THE INDUSTRY

Student courses program for Chemical Show announced. Equipment manufacturers form permanent organization headed by J. V. N. Dorr. Provisions demanded by the industry cause delay in ratification of chemical code and defer approval of codes for several related industries. Plans for fertilizer manufacture pushed vigorously by T.V.A. officials with other projects speeded up.

Technical Program Arranged For A. I. Ch. E. Meeting

THE fall meeting of the American Institute of Chemical Engineers will open at Roanoke, Va., on Dec. 12 and will continue for three days. A technical program has been arranged which on Dec. 12 will include: "Amortization, Depreciation, Obsolescence and Replacement" by Wyman P. Fiske, Assistant Professor of Accounting, Massachusetts Institute of Technology. "Recent Developments in Nitrogen Fertilizers" by C. L. Burdick, assistant chemical director, Ammonia Department, E. I. du Pont de Nemours Co. and "The Development of Air Conditioning in Industrial, Residential and Public Buildings; Its Effect on Human Beings; The Factors Which Enter Into its Design" by P. F. Davidson, Philadelphia district manager, Carrier Corp.

On Dec. 13, Sidney D. Wells, technical advisor, Combined Locks Paper Co., will read a paper on "A Printing Ink and Method for Discharging From Paper." There also will be a symposium on refrigeration with the following papers to be presented: "Refrigeration" by Frank Zumbro, engineer, The Frick Co.; "Water Vapor Refrigeration" by Paul Bancel, Ingersoll-Rand Co.; and "Various Liquids Used in Refrigeration" by J. B. Churchill.

For the closing session, the program calls for addresses on "Some Chemical Aspects of Coal Utilization" by H. H. Lowry, Coal Research Laboratory, Carnegie Institute of Technology and "Acetic Acid Dehydration" by Donald F. Othmer, Assistant Professor of Chemical Engineering, Polytechnic Institute, Brooklyn, N. Y.

Heating and Ventilating Exposition Scheduled

THE Third International Heating and Ventilating Exposition is scheduled for Grand Central Palace, New York, February 5-9, 1934. According to the International Exposition Co. who will manage the event, the contracts for space at this date indicate an exposition not only extensive in scope of exhibits, and number of exhibitors, but well balanced with regard to its major industrial sections. Principal among these are gas burning equipment, oil burners, warm air heating, steam heating, electric heating, refrigeration, air-conditioning, hydraulic accessories, thermal insulation, and instruments of precision. Instruments include those which indicate control or record the temperature, pressure, volume, time, flow, draft, or other functions to be measured.

There is a growing appreciation of the importance of controlled weather in connection with industrial processing. One valuable application has been in connection with the fabrication and use of thousands of articles made from wood. In candy-making also, controlled weather in the factory not only insures a better product but results in widespread economy.

Production of Natural Gas Declined in 1932

THE downward trend in the production of natural gas which was first evidenced in 1931, continued during 1932 when the marketed production amounted to 1,555,990,000,000 cu.ft., a decrease of 8 per cent from 1931. This decline was caused entirely by a general falling off in demand for industrial purposes as the consumption for domestic and commercial purposes continued to increase. The production had a value of $98,985,000 at the wells; its value at points of consumption was $384,632,000.

Total consumption of natural gas, production plus imports minus exports, amounted to 1,554,335,000,000 cu.ft., a decline of 8 per cent from 1931. Of the total, 529,378,000,000 cu.ft. (34 per cent) was used for field purposes, 385,887,000,000 cu.ft. (25 per cent) was used for domestic and commercial purposes, 168,237,000,000 cu.ft. (11 per cent) was burned in the manufacture of carbon black, 107,239,000,000 cu.ft. (7 per cent) was utilized at electric public utility power plants, 67,467,000,000 cu.ft. (4 per cent) was used at petroleum refineries, and 296,127,000,000 cu.ft. (19 per cent) was used for other industrial purposes.

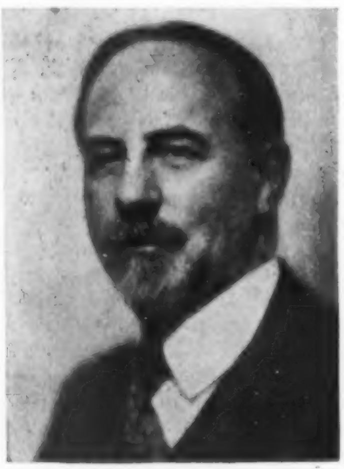
The quantity of natural gas used for field purposes, 529,378,000,000 cu.ft., although practically the same proportion of the total consumption in 1932 as in 1931, was 7 per cent below the 1931 total. A further curtailment of operations at carbon black plants resulted in a decline of 14 per cent in the amount of natural gas burned at such plants in 1932.

Illinois Will Give Short Courses in Ceramics

ANNOUNCEMENT is made by the Department of Ceramic Engineering of the University of Illinois, Urbana, Ill., that plans are being made for a series of Short Courses to be given in late January, 1934. These will include: Bodies and Glazes; Enamels; Structural Clay Products. Each will be complete in itself but a combination of the lectures on structural clay products and bodies and glazes is recommended. The structural clay products will be given during the first week and the other courses during the second week. Programs will be sent to applicants.

Dorr to Head Chemical Equipment Institute

AT ITS annual meeting held Oct. 31 in the Chemists' Club in New York, the recently organized Chemical Engineering Equipment Institute launched a broad program for self-government of the industry, looking toward a constructive improvement in trade practices and competitive conditions. A code of fair competition, which has been drafted by the industry, in cooperation with the Machinery and Allied Products Institute, was dispatched to Washington for official consideration by N.R.A. A permanent organization was evolved headed by John Van Nostrand Dorr, president of the Dorr Co., Inc., as president, and Henry D. Miles, president of the Buffalo Foundry & Machine Co., as vice-president. The nine men elected to the board of directors were as follows: S. F. Spangler, Chemical Construction Corp.; Percy C. Kingsbury, General Ceramics Co.; D. W. Sowers, Sowers Manufacturing Co.; A. W. Lissauer, Louisville Drying & Machinery Co.; W. E. Hall, The Duriron Co.; C. L. Campbell, E. B. Badger & Sons Co.; H. E. LaBour, The LaBour Co.; James E. Moul, Turbo-Mixer Corp.; and Arthur Wright, Arthur Wright & Associates.



John Van Nostrand Dorr

Temporary president H. D. Miles, who was largely responsible for the organization of the Institute, presided at the meeting and presented his report as its chief executive. He stated that conditions in the equipment industries, a year ago, were such that any manufacturer would look with toleration if not actually welcome even the most drastic changes that were necessary to avert disaster. A curb on unfair trade practices seemed desirable even at the expense of extending the influence of government in industry. Regimentation, he thought, may yet prove a sorry adventure, but if business men will strengthen their opposition to unsound principles, recovery can be directed along constructive lines. There has been some recession recently as a result of the threat of unionization or the fear of monetary inflation, but it is hoped that progress can be resumed in spite of these obstacles.

Secretary-Treasurer David H. Killeffer reported a membership of 35 concerns employing at least 1,200 people in the design, manufacture and distribution of chemical engineering equipment. It was stated that there are approximately 125 companies that might logically come within the purview of the Institute and a membership committee was later appointed by President Dorr to aid in extending the work and influence of the organization. It was thought that a number of smaller groups might eventually be persuaded to join with the Institute.

Samuel F. Spangler, reporting for the Auditing Committee, showed that the Institute had been able to meet all of its organization expenses to date and had a small cash balance. A tentative budget calling for total receipts of slightly less than $5,000 was suggested and later approved by the meeting.

Henry D. Miles

At the request of Mr. Miles, Eugene C. Clarke of the Bethlehem Foundry & Machine Co. explained the purpose for which the Machinery and Allied Products Institute was organized. At the present time it includes approximately 60 trade association groups interested in the capital or durable goods industries. It acts as a coordinating agency providing official representation in Washington, and helping to prevent the difficulties that would arise through duplicated activity within the machinery industry as a whole.

The revised code of the Chemical Engineering Equipment Industry, as approved by the members of the Institute, and incorporating certain minor changes suggested by M.A.P.I., is shortly to be submitted in Washington. The meeting authorized representation of the Institute by a Committee consisting of J. V. N. Dorr, president; D. H. Killeffer, secretary-treasurer; J. E. Moul, S. F. Spangler and John W. O'Leary of the Machinery and Allied Products Institute. This committee has power to act in filing the code and while its action is binding on the part of the Institute, the individual members reserve the right to withhold voluntary approval of any changes made in the code as submitted. It is probable that a public hearing will be held at an early date.

Forty Billion Dollars Lag In Equipment Buying

IN A recent interview John W. O'Leary, president of the Machinery and Allied Products Institute, stated that by the end of this year the United States will have fallen more than 40 billion dollars behind its capital goods requirements. He referred to an estimate made last August that there was an accumulated deficiency in industrial equipment and machinery purchases of $30,000,000,000, made up of $23,700,000,000 required to replace equipment which was obsolete at the end of 1932, and $6,300,000,000 required to make up deficiencies in purchases during 1930-1932 as compared with the 1919-1929 average. This average yearly purchase of industrial machinery and equipment was $4,853,000,000, whereas the 1930-1932 average was only $2,731,000,000.

Assuming that 1933 purchases will equal the 1930-1932 average the $6,300,000,000 will have grown to $9,000,000,000. This figure takes no account of new purchases which are required to replace equipment that will be obsolete at the end of this year. It is safe to assume that there will be a total deficiency at the end of this year of $40,000,000,000 or more.

Pointing out that previous depressions have taught that there can be no complete recovery until the capital goods industries have been restored to a healthy condition, he declared that producers must be supplied with new capital with which to purchase machinery, equipment and supplies. But the problem is not wholly a financial one. There must be a greater understanding and appreciation of the importance of durable goods manufacturing in our economic structure. The best solution of our difficulties will be in the most active cooperation on the part of manufacturer, banker and public official to establish firmly the fact that there can be no economic equilibrium so long as capital goods industries are stifled.

Arrangements Completed for Fourteenth Chemical Show

WITH companies from practically every section of the country as exhibitors the stage is set for the opening of the Fourteenth Exposition of Chemical Industries at Grand Central Palace, New York, on Dec. 4.

The exposition promises to afford a comprehensive survey of developments in the process industries. New products, new processes, raw materials, finished products, improvements in machinery and equipment, educational exhibits—all have their allotted places.

The students course which has been a feature of previous expositions will again be under the supervision of Prof. W. T. Read.

Each morning, beginning on Tuesday, Dec. 5, and continuing through Saturday there will be a program of lectures and addresses by leaders in the field of applied chemistry. In the afternoons and evenings the Exposition is open for inspection by student groups.

On Tuesday morning, Dec. 5, "Chemical Engineering as A Career" will furnish the theme and the discussion will include a general survey of chemical engineering, design of equipment, plant construction, research, sales, and administration. Speakers will include H. C. Parmelee, vice-president, McGraw-Hill Publishing Co.; Foster D. Snell, president, Foster D. Snell, Inc.; P. E. Landolt; and J. V. N. Dorr, president, The Dorr Co.

On Wednesday morning "Chemical Engineering in the Industries" will furnish the general topic and the program schedules for subjects and speakers: "The Petroleum Industry," by R. P. Russell, manager, Development Division, Standard Oil Development Co.; "The Inorganic Chemical Industries," by J. J. Healy, Merrimac Chemical Co.; "The Food Industries," by L. V. Burton, editor, *Food Industries;* "The Pulp and Paper Industry," by Harold R. Murdock, director of research, Champion Fibre Co.

"Recent Advances in Chemical Engineering" is scheduled for the session on Thursday morning. The subjects and speakers will be: "Improvements in Design," by Theodore R. Olive, associate editor, *Chemical & Metallurgical Engineering;* "Materials of Construction," by Lincoln T. Work, Professor Chemical Engineering, Columbia University; "Process Control," by M. F. Behar, editor, *Instruments;* "New Types of Equipment," by D. H. Killeffer, secretary, Chemical Engineering Equipment Institute.

The Friday morning session will be devoted to the "Economics and Products of Chemical Industry." The program comprises: "Chemical Economies in the Plant," by Chaplin Tyler, Ammonia Department, E. I. duPont de Nemours & Co.; "Sale and Marketing of Chemical Products" by Williams Haynes, publisher *Chemical Industries;* "Role of Chemistry in International Relations," by H. E. Howe, editor, *Industrial & Engineering Chemistry.*

The program for Saturday morning is designed for teachers and instructors of chemistry in high schools and colleges. It will open with an address on: "Chemical Reports — Written and Spoken," by R. E. Rose, director, Dyestuffs Division, E. I. duPont de Nemours & Co., followed by "Chemical Engineering Education," by R. S. McBride, editorial representative, *Chemical & Metallurgical Engineering,* and "What Training Industry Expects," by G. W. Thompson, chief chemist National Lead Co.

Fraternity Dinner

Alpha Chi Sigma, professional chemical fraternity, announces that its Chemical Exposition dinner is to be held on Wednesday, Dec. 6. The place of meeting and the program are to be available at the fraternity registration desk in the booth of Palo-Meyers, Inc., Booth 340.

One Hundred Students Attend A.I.Ch.E. New York Meeting

MEETING at the Chemists' Club on the evening of Oct. 27, for its first fall meeting, the New York Section of the American Institute of Chemical Engineers listened to an address by Dr. H. C. Parmelee, vice-president of the McGraw-Hill Publishing Co., on "Modern Trends in Engineering Education." Approximately fifty members of the New York Section dined in the Frasch Room of the club before the meeting, which was also attended by about 100 chemical engineering students from the College of the City of New York, Cooper Union, Columbia, New York University, Rutgers, Princeton, Yale, Pratt Institute of Brooklyn, and Brooklyn Polytechnic Institute, as guests of the local section.

Dr. Parmelee, in his address, summarized the work being done by the Engineers Council for Professional Development on which are represented the Four Founder Engineering Societies, the American Institute of Chemical Engineers, National Council of State Boards of Engineering Examiners, and the Society for the Promotion of Engineering Education.

In the absence of Percy Landolt, chairman of the Local Section, Dr. Lincoln T. Work presided. Albert E. Marshall, vice-president of the Institute, represented the national organization and introduced the principal speaker. Drs. George A. Prochazka, W. M. Grosvenor, and John C. Olsen also spoke.

Chemical Industry More Active in Germany

REPORTING from Frankfort-on-Main, Consul General W. L. Lowrie states that the quarterly report of the I. G. Farbenindustrie, leading chemical producer in Germany, affords a general picture of conditions in the leading branches of the German chemical industry. It states that there has been a continued improvement in chemical production and trade as a result of the Government work-providing campaign. The improvement is limited to the domestic market where the Reich measures intended to provide employment for the idle and inject new life into industry have quickened commercial turnover and raised the volume of production. This stimulating influence is expected to be a factor in the business development for the future. Conditions in export business remained unchanged.

The condition of dyestuffs trade showed no distinct change against the second quarter of 1933. In industrial chemicals, the volume of orders received places this quarter on par with the second quarter of 1933 which means a substantial improvement over the third quarter of 1932. Production of fertilizer nitrogen was maintained on the level of the preceding quarter, the rate of production being based on sales estimates for the fertilizer year 1933-1934. The actual sale of nitrogen fertilizers during the third quarter showed a slight increase over the corresponding period of 1932. Production of motor fuel was increased further, with increased relative importance of the part produced directly from lignite. Domestic sales of pharmaceuticals and insecticides showed important improvement. Photographic chemicals and articles exhibited the customary seasonal activity.

Firestone Produces Stainless Steel Containers

ANNOUNCEMENT is made by the Firestone Steel Products Co. of Akron, Ohio, of a line of steel containers for the food, drug, chemical, fruit juice, syrup, vinegar, soap, and other industries now using wood or steel containers. The Firestone container is furnished in either the double wall insulated type or a single wall design and practically any size or design is furnished from one gallon up in either stainless or carbon steel, according to requirements of the customer.

The first type of container the company has put into production is the stainless steel beer barrel made of double walls of steel, with the outer wall of heavy gage carbon steel corrugated for strength and the inner shell of smooth, sanitary, stainless steel requiring no pitching or other attention.

NEWS FROM WASHINGTON

By PAUL WOOTON

Washington Correspondent of Chem. & Met.

NOW in its fourth edition, the code of the Chemical Alliance still was stranded in NRA, Oct. 12. The industry was holding out for provisions patterned after the automotive code and that, with respect to others, have since been repudiated by the Recovery Administration. The industry's demand for inclusion of the merit clause and a stipulation that no substantial change shall be made by President Roosevelt, without the consent of the industry, in any article of the code as submitted to him blocked the progress of negotiations. The right to cancel on 30 days' notice after the expiration of 90 days, also was a debatable issue.

A serious consequence of the apparent deadlock is the delay to numerous subordinate codes waiting for consideration on the basis of principles embodied in the master code. In the meantime, the codes of several related industries have been approved. The code of the wood chemical industry had been forwarded from NRA to the White House and the fertilizer code went into effect Nov. 10, soap and glycerine Nov. 13, and paint, varnish and lacquer Nov. 15. The paint and fertilizer codes represent the culmination of years of effort dating back to the time when these associations sought under the auspices of the Federal Trade Commission to wipe out unfair practices, but production, labor and pricing provisions of the new codes vastly extend the scope of industrial discipline lacking the arbitrary restraints of the anti-trust laws.

The first effect of the fertilizer code will be to advance wages 60 per cent, according to Charles J. Brand, executive secretary of the National Fertilizer Association. Practically doubling the labor cost of making fertilizer will necessitate some increase in price to the farmer, but Mr. Brand is confident that this increase will not be out of line with the rise in farm purchasing power in recent months. Farm product prices are now 70 per cent and fertilizer prices at the factory 77 per cent of pre-war, in contrast with last March when farm prices were only 50 per cent and fertilizer 71 per cent of pre-war.

T.V.A. Speeds Up

In response to Presidential admonition and to public demand for action, several projects of Tennessee Valley Authority have been pressed aggressively of late. Actual construction of Norris Dam at Cove Creek, appointment of construction executives for Wheeler Dam (Dam No. 3), and new work on highways, C.C.C. camps, and like projects, is evident. For the long-distance power line from Muscle Shoals to Cove Creek an order has been placed for 675 miles of aluminum conductor, at prices lower than those offered for copper.

Plans for fertilizer manufacture are proceeding vigorously. Completion of designs early in 1934 is expected for the new type phosphoric acid furnace. Construction will then follow immediately. Extensive use of fertilizer on grass lands for prevention of erosion is contemplated. No plans for commercial marketing of other quantities have yet been perfected.

No decision has been reached regarding production or purchase of the ammonia needed. Potash purchase seems sure; manufacture will be limited to experimental quantities, probably to laboratory scale operations.

Fertilizer Code Administration

Methods for fertilizer code administration were the major theme of the Southern Convention of the National Fertilizer Association during the week of Nov. 12. This code applies not only to those manufacturing or importing superphosphate, mixed fertilizer, and fertilizer materials, but also other chemicals manufacturers who distribute any such goods as superphosphate, fertilizer chemicals, and their mixtures. Thus the code applies to these chemical enterprises whenever they engage in this merchandising practice within the fertilizer trade.

The N.R.A. fertilizer code is much more comprehensive than the old code of fair practices adopted by the industry under Federal Trade Commission auspices. Furthermore, it has teeth permitting enforcement. Rather enthusiastic reception has, therefore, been accorded it. Most radical results under it are expected from open price agreement features, price schedules for which were required to be filed with the N.F.A. by Nov. 15. Each concern is also required to mail copies of these price schedules and subsequent changes therein, not only to the Association central office, but also to each competitor. This is the first case in which a chemical engineering enterprise has gone so far in open price arrangements.

Alcohol Regulation

State action on "repeal" necessitates entirely new Federal plans covering beverage and industrial alcohol matters. The seemingly complicated situation has been much simplified by ingenious new plans just announced in Washington. In effect, we shall have three regulatory plans functioning, presumably effective early in December.

(1) Treasury Department control for tax purposes will continue to supervise production, denaturing, and marketing of industrial alcohol. It is expected that Commissioner Doran, head of the industrial-alcohol bureau, will be continued as chief of the division of the Bureau of Internal Revenue, which has charge of these matters. No major modifications in the permit system need be expected.

(2) Beverage alcohol matters will be at least temporarily supervised by Secretary of Agriculture Wallace. He is to arrange for the adoption, and presumably enforcement, of an alcohol beverage code. This will cover beer, wines, distilled liquors, and all other types of significance. Authority rests on "emergency legislation," according to an important spokesman of AAA. Under NRA and AAA authority combined, all of which lodges with Wallace on any food or beverage matter, there is sufficient machinery to care for these matters through code adoption and licensing procedures. Beverage manufacturers indicate their desire to co-operate.

(3) Food and Drug Administration authority covers all matters of labeling, adulteration, etc. This authority has always existed here since 1906 when the original food and drug law was enacted. Many details not pertinent to other industries working under NRA or AAA can be handled through the use by Secretary Wallace of this legislative authority resident in the subsidiary Food and Drug Administration of his own department.

It is expected that all alcohol beverages will be based on the processing of American grown agricultural materials, except of course imported beverages. It has not been determined whether the "cutting" of whiskey with alcohol other than from grain will be permitted or not. Farm leaders would like to have a grain requirement made law next winter. As a policy it may take effect even sooner by becoming a provision of the proposed beverage code. If such code requirement is adopted, the result is quite as effective, and just as enforcible, as would be a Congressional act of the same import. Clearly it is going to be the policy of Washington officials to make some such

distinction between industrial alcohol, which may come from any source, and beverage alcohol, which they think should be limited to that from domestic grain or domestic produced agricultural material of other sort. Some officials even go so far as to say that alcohol from imported blackstrap molasses will find no place in the beverage industry at any time in the future.

During October new production quotas for additional alcohol making were alloted by the Bureau of Industrial Alcohol to present manufacturers. These reflect the renewed activity of alcohol-using industries (not beverages). The result will be about a 20 per cent increase in alcohol production.

Proposed regulations to govern water transportation of explosives and a variety of other chemicals generally denominated as "dangerous articles" have been distributed by the Interstate Commerce Commission. In process since 1924, the latest revised draft is the result of conferences held in September between the Explosives Section of the Commission's Bureau of Service, the North Atlantic conference of steamship lines and the American Petroleum Institute.

The regulations recognize that the lading must be interchangeable between rail and water transport services and, with minor exceptions, the packing prescribed is the same. The scope of the regulations is not defined exactly but, in general, they are intended to apply in either direction.

On shipments in foreign trade a reciprocal principle is proposed. Exports from the United States must be loaded and stowed according to I.C.C. regulations but must be packed, marked and described according to the practice required at the foreign port of destination. Import shipments may be loaded and stowed according to practice at the port of export but must be packed, marked and labeled according to the rules prescribed by the I.C.C.

Protests may be filed with the I.C.C. within 20 days and it is probable that they will be lively as the recommended regulations, as edited by the explosives section of the Commission, do not incorporate the proposal of the Port of New York Authority that they be enforced by the federal government. Because of the hazard to river tunnels and other structures the Port Authority would have the Commission require inspection of all vessels in the outer harbor and a certificate from the master of the vessel that his lading complies with the I.C.C. regulations.

Under the law the Commission has authority only to prescribe regulations for safety in transportation. It does not have a dollar for enforcement. Regulations on rail shipments are enforced by the Bureau of Explosives of the American Railway Association.

Codes Adopted

The following codes have been officially approved and adopted with the dates on which they become effective as below:

Fertilizer	Nov. 10
Paint, varnish and lacquer	Nov. 15
Soap and glycerine	Nov. 13
Liquefied gas	Nov. 8
Wood chemical	Nov. 13

Japan Increases Production Of Artificial Indigo

JAPANESE production of artificial indigo has developed to a stage where it is nearly sufficient to satisfy the domestic textile industry's large demand for that dyestuff, according to advices to the Department of Commerce.

The growth of this new industry in Japan is revealed by figures for production and imports during the last four years. In 1929 Japan produced artificial indigo valued at only 134,000 yen and imported in that year supplies valued at approximately 2,000,000 yen. In 1932 production had risen to a value of 630,000 yen with imports down to 1,425,000 yen. During the first six months of the current year Japanese output of this dyestuff had risen to 1,045,000 yen while total imports amounted to only 30,000 yen.

Most of the artificial indigo now made in Japan is produced by the Nihon Dyestuff Manufacturing Co., which recently increased its capital from 7,000,000 to 15,000,000 yen, and the Miike Mining Co., one of the Mitsui interests. Both of these concerns, the report shows, have recently expanded the capacity of their plants for the production of artificial indigo.

Newly instituted Chemical Industry Medal presented by the American Section of the Society of Chemical Industry. First award made to James G. Vail, vice-president of the Philadelphia Quartz Co.

Appeals Court Sustains Du Pont Duco Patent

THE U. S. Circuit Court of Appeals for the Second Circuit in New York has, after rehearing, unanimously sustained the du Pont company's patent relating to the manufacture of "Duco," for infringement of which the du Pont company had sued The Glidden Co. This latest decision, rendered Nov. 13, was on a petition filed by The Glidden Co. for a rehearing of the case which was decided against it by the Circuit Court of Appeals last July.

At that time, the Circuit Court of Appeals reversed a decision of the United States District Court for the Eastern District of New York, in which the case had first been heard when the du Pont company brought suit for infringement.

The du Pont company's claim, which has now been sustained, was that the Glidden company was making and marketing a coating or painting composition to which the du Pont company had the exclusive rights, based on a patent on an invention by Edmund M. Flaherty of the du Pont company.

Florida Chemists Prepare For A.C.S. Meeting

DR. W. H. BEISLER, chemistry professor at the University of Florida was elected chairman Florida section of the American Chemical Society at a meeting in Gainesville, Ga., Nov. 4, held to make preparations for the national meeting of the society in St. Petersburg, Fla., next spring. Dr. J. F. Conn, head of the department of chemistry at Stetson University, was named vice-chairman; Dr. C. B. Pollard, of the University of Florida, councillor; B. J. Otte, of the University of Florida, secretary-treasurer. B. F. Floyd, Davenport, was named representative of the Florida section on the Senate of Chemical Education. At the evening session, Dr. R. C. Williams, head of the department of physics at the University of Florida, and Dr. R. W. Ruprecht, of the College of Agriculture, Gainesville, were speakers.

Chemical Companies Asked to Aid Unemployment Fund

AT A recent meeting of the representatives of the sponsoring societies and honorary members of the Committee on Unemployment and Relief for Chemists and Chemical Engineers in metropolitan New York a committee was appointed to secure funds for the coming winter. A. Cressy Morrison accepted the chairmanship and he was promised the assistance of William W. Buffum, vice-chairman; George F. Hasslacher and Dr. W. T. Read.

NAMES IN THE NEWS

JOHN T. TIERNEY has been elected president and J. P. Williams, Jr., vice-president, of the Koppers Co. Mr. Tierney has been associated with the company for 17 years. He first joined the Koppers' interests as superintendent of the Seaboard By-Product Coke Co. at Kearny, N. J. For many years Mr. Williams has been in charge of the mining operations of the company. Other appointments include C. D. Marshall, chairman of the executive committee; H. B. Rust, chairman of the board; and W. F. Rust, vice-chairman.

EDWIN C. MARKHAM of the chemistry staff of the University of Virginia has transferred his activities to the University of Delaware.

PAUL V. BROWER of the University of Chicago has accepted a position with the Ditto Co., Chicago, Ill.

JOSEPH S. HICKS has joined the staff of the Acme White Lead and Color Works of Detroit, Mich.

C. W. LENTH has joined the Minor Laboratories, Chicago, Ill.

O. S. SLEEPER, formerly connected with J. P. Devine Mfg. Co., has been made manager of the chemical equipment sales department of Goslin-Birmingham Mfg. Co., Birmingham, Ala.

EUGENE L. MAINES, formerly chief chemist with Lehn & Fink, and Strong, Cobb & Co., has formed the E. L. Maines Co. in Cleveland.

JOHN ROACH, deputy commissioner of labor for New Jersey, has been elected general chairman of the Chemical Section of the National Safety Council. A. L. Armstrong, of the Eastman Kodak Co., has been elected vice-chairman in charge of program; G. H. Miller, of E. I. duPont de Nemours & Co., vice-chairman in charge of engineering; and Ralph C. Keefer, of Aluminum Co., secretary.

JOHN MORONEY, of the Aluminum Co. has been chosen to edit the *News Letter* of the Chemical Section. Other committee chairmen include: Ira V. Kepner, Pennsylvania Salt Mfg. Co., S. D. Kirkpatrick, editor of *Chem. & Met.*: and Leonard Greenburg, Yale Medical School.

James G. Vail

JAMES G. VAIL, vice-president and chemical director of the Philadelphia Quartz Co., was presented the Chemical Industry Medal by the American Section of the Society of Chemical Industry on Nov. 3. The award was made to Mr. Vail for his work on sodium silicates.

This is a newly instituted award and will be given annually to a person who has made a valuable application of chemical research to industry, primary consideration to be given to applications in the public interest. It will take the place of the Grasselli Medal which has now been discontinued.

C. W. SONDERN is employed in the research laboratories of the W. S. Merrill Co., Madison, Wis.

COLIN G. FINK, professor of electrochemistry at Columbia University, and secretary of the Electrochemical Society, has been elected to receive the Perkins Medal for 1934 of the Society of Chemical Industry. The medal is awarded for valuable work in applied chemistry and will be presented to Dr. Fink for his inventions in the fields of electrochemistry and metallurgy. Selection was made by a committee representative of five of the national chemical societies. Presentation of the medal will be made at a meeting in New York early in January.

FREDERICK G. COTTRELL, who has had charge of the Tennessee Valley Authority's fertilizer experimental work since the agency was established last spring, has been named chief consulting chemist.

M. F. DULL and ORTON HIXSON, formerly of Northwestern University, are employed in the laboratory of Mariner and Hoskins.

JOHN S. CONROE has become a member of the process equipment department of the Blaw-Knox Co., Pittsburgh. He has been with the Struthers-Wells Co., Warren, Pa., for the past four years.

GEORGE GAY, III, has assumed his duties as a member of the chemistry staff of the Medical College of Virginia.

W. A. PEABODY has resigned from the chemical department of the Medical College of Virginia. Dr. Peabody will give all his time as biochemist to the Valentine Meat Juice Co.

KEITH T. SWARTZ is now located in Chicago where he is employed by the Continental Can Co.

L. W. PARSONS, chief chemical engineer of the Tide Water Oil Co. was a passenger on a recent trip of the Graf Zeppelin. Dr. Parsons has served as fuel adviser to the staff of the airship.

MILTON WRUBLE is now associated with the Upjohn Co., Kalamazoo, Mich.

GEORGE A. WILKENS, who recently received his Ph.D. degree from Columbia University, has accepted a position with the duPont Viscoloid Co. at Arlington, N. J.

WILLIAM WALDECK has been appointed director of research by the Pittsburgh Plate Glass Co. Dr. Waldeck received his doctoral degree in June from New York University.

JOHN RIPLEY FREEMAN of Providence, R. I., has been awarded the John

CALENDAR

FOURTEENTH EXPOSITION OF CHEMICAL INDUSTRIES, New York, week of Dec. 4-9, 1933.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, fall meeting, Roanoke, Va., Dec. 12, 13, 14.

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY, spring meeting, New York, Feb. 19-22, 1934.

AMERICAN CHEMICAL SOCIETY, spring meeting, St. Petersburg, Fla., week of Mar. 25, 1934.

ELECTROCHEMICAL SOCIETY, and AMERICAN CERAMIC SOCIETY, joint meeting, Asheville, N. C., April 26-28, 1934.

Fritz Medal. The award was made posthumously because of the sudden death of Mr. Freeman on Oct. 6, during the procedure for his selection as a medalist, according to an announcement by the board of award, composed of 16 recent past-presidents of the four national societies of civil, mining and metallurgical, mechanical and electrical engineers.

LYMAN C. NEWELL professor of chemistry in Boston University is at Oqunquit Me., recovering from an attack of pneumonia.

C. F. WINANS has assumed his duties in the research laboratories of the National Aniline & Chemical Co.

SANDFORD S. COLE, who was connected with the Koppers research organization at Mellon Institute for several years, is studying for his Ph.D. degree at Pennsylvania State College.

WILLIAM S. WALLS, who recently received his Ph.D. degree from Princeton University is working at the Experimental Station of the Pennsylvania State College. Dr. Walls is working under the auspices of a fellowship sponsored by the Bradford District, Pennsylvania Oil Producers' Association.

R. W. MCNAMEE is now with the Carbide and Carbon Chemicals Corp. at the South Charleston, W. Va., plant.

A. H. HOMEYER has joined the chemical research staff of Mallinckrodt Chemical Works, St. Louis, Mo.

HARRIS ROWE has been appointed instructor in the chemical department of the University of Louisville, Louisville, Ky.

R. C. ERNST is now head of the department of chemical engineering of the Speed Scientific School, Louisville.

R. C. HARING, formerly at the University of Wisconsin, is now associated with the National Aniline & Chemical Co.

ELLIS D. SLATER has been appointed vice-president of the Frankfort Distillery, Inc., with offices in New York City. For 13 years Mr. Slater was in the sales department of the U. S. Industrial Alcohol Co.

ERNEST T. TRIGG has resigned the presidency of John Lucas & Co., Philadelphia, and has accepted the presidency of the newly organized National Paint, Varnish and Lacquer Association. He will make his home in Washington, D. C.

HARRY L. DERBY, presdent of the American Cyanamid & Chemical Corp., is a member of the executive committee of the Family Welfare Committee of New York City.

C. S. NEAL, production manager of all Sherwin-Williams paint and varnish factories, was honored on Nov. 6 at a combined banquet meeting of the Foremen's Club and the Cleveland Junior Club.

W. F. GEDDES has resigned his position as associate professor of chemistry at the University of Manitoba, Agricultural College, Winnipeg, and has accepted a position as chemist in charge of the Dominion Grain Research Laboratory, at Winnipeg.

CHARLES C. CONCANNON, genial chief of the Chemical Division, Bureau of Foreign and Domestic Commerce, recently addressed the annual meeting of the Association of British Chemical Manufacturers. His subject was "National Industrial Recovery in America." One of his attentive auditors produced this sketch of "Conn in London," reproduced here from *Chemistry and Industry* of Nov. 3.

EUGENE JOHNSON, formerly an instructor in the chemical department of Washington & Lee University, is now employed by the duPont company at the rayon plant in Waynesboro, Va.

WILLIAM H. ALLEN, JR., has been selected by the Foster-Wheeler Corp. to represent its interests in the Coal Process Corp., New York City. Mr. Allen was formerly associated with the Semet-Solvay Co.

C. J. RAMSBURG, vice-president of Koppers Coke Co., Pittsburgh, has been appointed by the N.R.A. as advisor for the structural steel and iron fabricating industry.

OBITUARY

DR. GEORGE RAYMOND TUCKER, research chemist for the Dewey & Almy Chemical Co., Cambridge, Mass., died at the Lawrence General Hospital on Nov. 10 following an operation. He was born at Swampscott, Mass., 29 years ago, and was a graduate in chemical engineering at the Massachusetts Institute of Technology.

WILLIAM COYNE, a director and vice-president of E. I. duPont de Nemours & Co., died Oct. 31. He died from a heart attack at his home in New York City at the age of 67 years.

WILLIAM T. ELKINTON, chairman of the board of the Philadelphia Quartz Co., died Oct. 25 at the age of 73 years. Through more than 50 years of active business life, which saw the company expand from a local enterprise to a business of national scope he consistently remembered his religious and philanthropic responsibilities. Mr. Elkinton was the third generation of his family in the business which celebrated its centenary in 1931.

OTIS FISCHER BLACK of the U. S. Bureau of Plant Industry, died from a heart attack while walking to his laboratory on the morning of Oct. 14. He was 67 years old. Mr. Black was educated at Harvard and Northwestern and taught chemistry at the former for 14 years before going to the Capital. He won wide recognition in extracting alkaloids from poisonous plants.

JAMES HALLER GIBBONEY, chief chemist of the Norfolk & Western Railway, died Oct. 30, in Roanoke, Va., following an abdominal operation.

HERBERT E. SMITH, professor of chemistry and head of the medical school of Yale University from 1885 to 1910, died in his sleep at his home in Los Gatos, Calif., Oct. 9. He was 76 years old.

CHARLES F. ABBOTT, formerly director of commercial research for the National Aniline & Chemical Co., died Oct. 27, in New York City. He was 57 years old.

HENRY R. JESSEL, head of the department of chemistry at Marquette University, Milwaukee, Wis., died of heart disease Oct. 15. He was 66 years old.

MARSHALL PERLEY CRAM, professor of chemistry at Bowdoin College, Brunswick, Me., died Oct. 10. He was 51 years old. Dr. Cram became ill several months ago while traveling in Europe.

CHEMICAL ECONOMICS

Despite reports that some consuming industries were cutting down requirements for raw materials production of chemicals was on a larger scale in October. In some cases only slight increases over September were reported but seasonal conditions brought substantial gains in some branches of the industry and the index of production shows a new high for the year.

FOR THE greater part, production of chemicals in October went ahead at about the same rate as reported for the preceding month. A few branches, notably solvents, made considerable progress over earlier months and brought total production not only above that for September, but also created a new high for the year. This deduction is based on a monthly comparison of electrical power consumption. The index number for October is 133.2, which compares with 130.4 for September, no adjustment being made for the difference in the number of working days.

In the accompanying compilation, data are given to show the progress made by important chemical and chemical-consuming industries for the first three quarters of this year. Totals for the first three quarters of 1932 are included, together with percentages of change fot the corresponding nine-month periods. For the periods enumerated, the figures give fairly definite comparisons for consumption of chemicals in the automotive, glass, paint and varnish, textile, fertilizer, oil refining, rubber, artificial leather, and leather trades.

Some recession in activities in the chemical-consuming industries is indicated for the final quarter of this year. In most cases, however, the comparison with the final quarter of 1932 is favorable. For instance automobile production for the quarter will be about 300,000 units or about 40 per cent higher than for the last quarter of 1932. Substantial percentage gains also are indicated for the paint and varnish, glass, and fertilizer industries.

For the first eight months of the year production of chemical wood pulp amounted to 1,713,354 tons, which compares with 1,304,268 tons for the corresponding period of 1932, or a gain of 31.4 per cent for the 1933 total. Consumption of crude rubber for the first three quarters of 1933 reached a total of 274,514 long tons, compared with 232,947 long tons for the like period of 1932, or a gain of 17.8 per cent for the current year. Consumption of fertilizer in the Southern States for the January-September periods was 2,889 thousand tons in 1933 and 2,424 thousand tons in 1932—an increase of 19.2 per cent, which promises to be extended by the end of the year.

Late figures for production of industrial alcohol are not yet available, but it is reported that the output has been speeded up from October forward, with large shipments made to the anti-freeze trade. Production of pure ethyl alcohol also has been greatly expanded, with producers' quotas officially increased.

The seasonal increase in business usual during October failed to appear last month, the Commerce Department stated in its survey of current business. Industrial production continued to recede, although the decline was not as rapid as in August and September.

More than 600,000 persons were returned to work in September and there was a substantial increase in payrolls, the Department stated. Factory employment increased 4.4 per cent and payrolls were up 3.4 per cent.

Seasonal dullness in demand for rayon is forecast for the remainder of the year by *Textile Organon*. This will give producers an opportunity to fill in and balance stocks. It is pointed out that since June, deliveries of rayon had to be made almost entirely from current production. Indexes for rayon deliveries compare as follows:

(Daily average 1923-25—100)

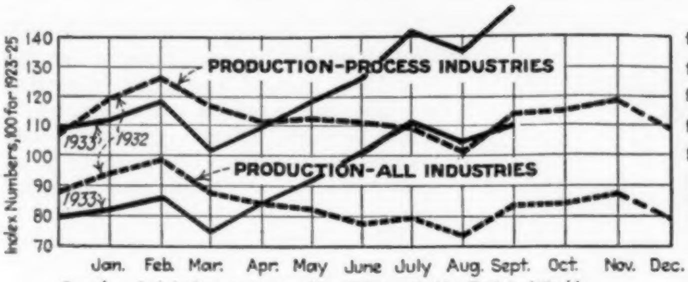
	Oct.	Sept.	Aug.	July	Yearly average
1933 ..	399	433	420	470	*393
1932 ..	413	478	406	213	293
1931 ..	268	335	349	312	317
1930 ..	264	304	219	179	244
1929 ..	358	337	281	240	277
1928 ..	265	242	197	169	214
1927 ..	227	211	195	190	214
1926 ..	159	151	138	118	131
1925 ..	134	127	128	124	132
1924 ..	119	116	86	71	93
1923 ..	82	70	50	70	75

*Daily average for 1933 to date.

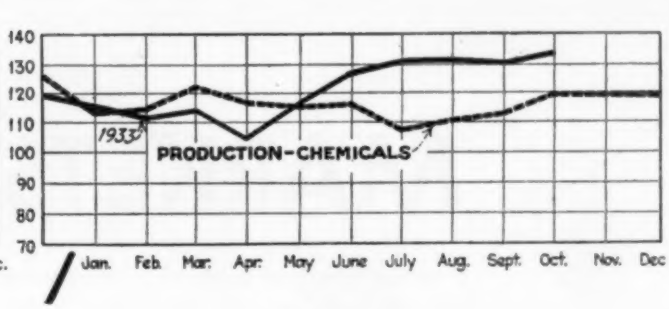
Activities in Chemical and Chemical-Consuming Industries

PRODUCTION	First Quarter 1933	Second Quarter 1933	Third Quarter 1933	First Three Quarters 1933	First Three Quarters 1932	Per Cent of Gain in 1933
Acetate of lime, 1000 lb	12,282	7,013	10,461	29,756	22,522	32.1
Methanol, crude, 1000 gal	837	539	716	2,092	1,699	23.1
Methanol, refined, 1000 gal	407	276	442	1,125	1,015	10.8
Methanol, synthetic, 1000 gal	856	1,349	2,884	5,089	5,887	13.6x
Alcohol denatured, 1000 wine gal	11,670	13,487	18,125	43,282	49,094	11.8x
Arsenic, crude, ton	2,783	2,135	3,084	8,002	12,729	37.1x
Arsenic, refined, ton	2,605	1,678	1,856	6,139	8,084	24.1x
Automobiles, No	354,818	652,292	665,657	1,672,767	1,155,066	44.8
Boots and shoes, 1000 pr	77,677	95,225	101,887	274,789	234,976	16.9
By product coke, 1000 tons	5,090	5,818	8,432	19,340	15,890	21.7
Cotton finishing, 1000 yd	277,819	263,220	222,906	763,945	497,411	53.6
Glass containers, 1000 gr	4,925	5,268	6,972	17,165	15,838	8.4
Glass, plate, 1000 sq. ft	16,770	23,125	32,952	72,847	37,205	95.8
Linseed oil, 1000 lb	79,595	79,034	113,413	272,042	234,050	16.2
Petroleum refined, 1000 bbl	195,119	217,781	233,992	646,892	621,797	4.0
Pyroxylin spread, 1000 lb	6,828	11,409	10,800	29,037	19,030	52.6
Rosin, wood, bbl	83,368	91,134	127,207	301,709	248,284	21.5
Turpentine, wood, bbl	13,405	14,373	19,937	47,715	40,228	18.6
Sulphuric acid, in fertilizer trade, ton	293,771	241,036	364,449	899,256	630,051	42.7
Rubber reclaimed, ton	12,903	22,160	32,140	67,203	53,236	26.2
CONSUMPTION						
Cotton, 1000 bales	1,407	1,798	1,676	4,871	3,570	36.4
Silk, bales	117,803	142,688	118,634	379,125	415,612	8.8x
Wool, 1000 lb	93,731	134,287	163,538	391,556	267,604	46.3
Paint, varnish and lacquer, sales, $1000	36,520	73,098	61,808	171,426	165,754	3.4
Sulphuric acid, in fertilizer trade, ton	266,089	192,397	283,154	741,640	489,581	51.5
Linseed oil, 1000 lb	39,021	76,975	70,824	186,820	175,994	6.1xx

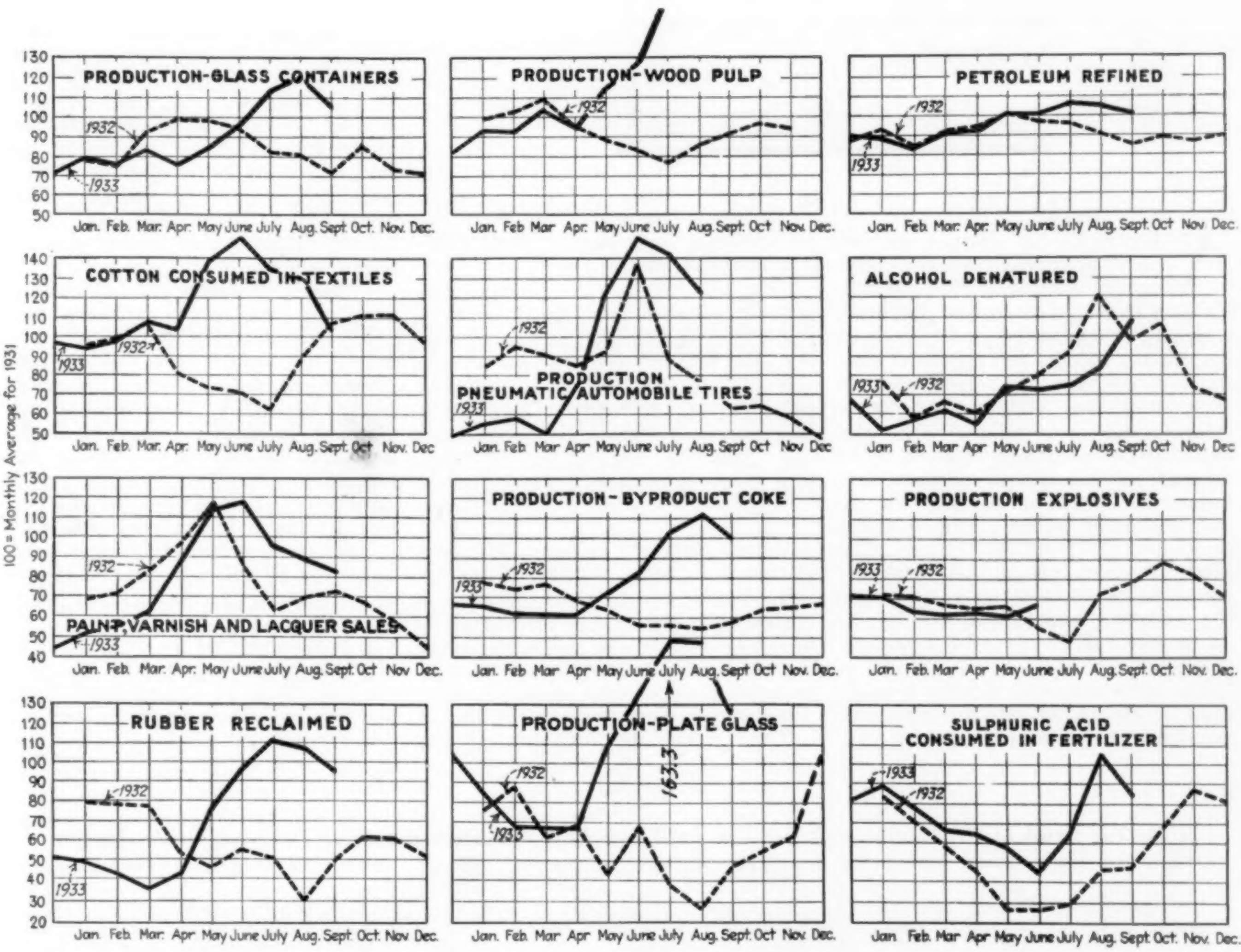
x Per cent of decrease. xx Factory consumption only.

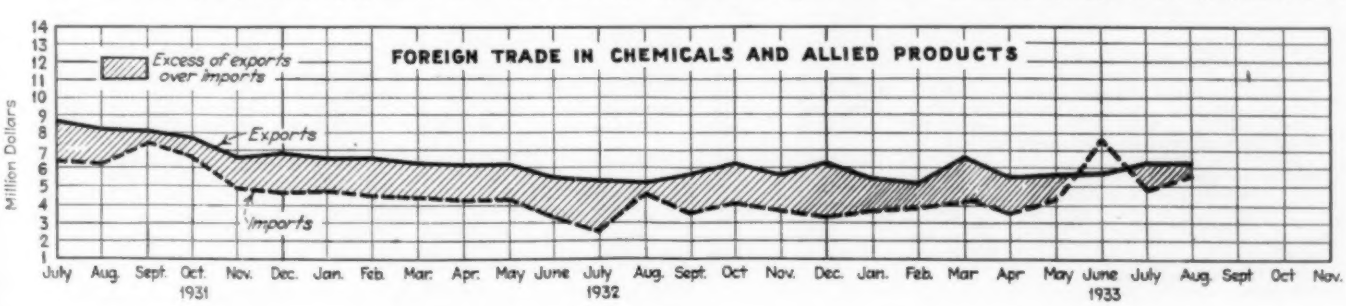


Based on electrical power consumption, data supplied by Electrical World



TRENDS OF PRODUCTION AND CONSUMPTION





MARKETS

Announcement of higher contract prices for soda ash, caustic soda, liquid chlorine, and bleaching powder was most important development of the month in the market for chemicals. Processing taxes enter as a price factor on some commodities. Trading is irregular with some materials finding increased outlets and others affected by slower consuming demand.

AN IRREGULAR demand was reported as representative of trading in chemicals last month. Some of the large consuming industries continued to operate below the levels of the summer months and restricted their call for raw materials accordingly. In other cases, fear of impending higher prices developed some quiet accumulation of stocks. As a case in point, active demand was reported in starches, dextrines, and other corn products in anticipation of higher prices to follow as a result of the processing tax. The grind of corn reflects this condition, with estimates that the grind for October reached a total of 5,761,000 bu., or an increase of 29 per cent over September.

The most important market development of the period was the announcement of higher contract prices for alkalis, chlorine, and bleach. The alkali schedule is as follows:

	Per 100 lb.
58% light soda ash, bulk	$1.05
58% light soda ash, paper	1.20
58% light soda ash, burlap	1.23
58% light soda ash, bbl.	1.50
58% extra light soda ash, bulk	1.05
58% extra light soda ash, burlap	1.23
58% extra light soda ash, bbl.	1.60
58% dense soda ash, bulk	1.10
58% dense soda ash burlap	1.25
58% dense soda ash, bbl.	1.50
76% caustic soda, solid, drums	2.00
76% caustic soda, flake, drums	3.00
50% caustic soda, liquor, seller's tank cars	2.25

While contract business in some chemicals is being written at current price levels, there is, in general, a tendency on the part of producers to hold orders to nearby deliveries, or to include provisions for price revisions if government regulations or money inflation make the business unprofitable.

The uncertainty regarding future costs for producing chemicals is largely bound up in the provisions which the code will impose, and delay in getting the code into working shape is not having a beneficial effect on trading. Codes signed during the month included paint and varnish, fertilizer, and liquefied gas.

While demand for industrial alcohol for the year to date has been disappointing, there has been a material gain in shipments to the anti-freeze trade from October on. Methanol also has been moving freely, and it is reported that the plant of the Tioga Wood Products Co., at Morris, Pa., which has been closed for a long time, has been sold and again will be used to produce methanol and other wood distillation chemicals.

A hearing is scheduled at Jacksonville on Nov. 20 on the proposed marketing agreement submitted to the AAA by the American Gum Farmers Association. In substance, the agreement proposes to stabilize production and sale of rosin and turpentine with a control committee in charge. Shipments will be on a quota basis, based on the amounts produced by the different factors.

Domestic producers and importers of chemicals and related products have shown considerable interest in the procedure as outlined for making complaints against imported materials. Under the NRA, the President may place an embargo on imports, license importers, or limit the volume of import shipments. This to apply only in cases where it is proved that the volume of imports is increasing sufficiently to depress materials of domestic manufacture or to endanger the maintenance of a code or agreement in a given industry.

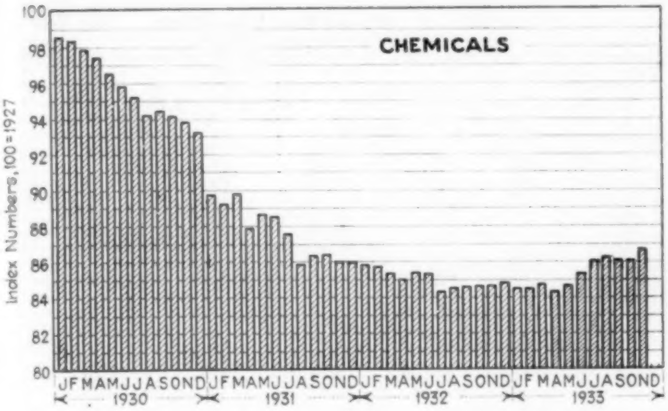
It is reported that the import division of AAA is now engaged in investigating the effects of imports on domestic products and that vegetable oils and fats are included.

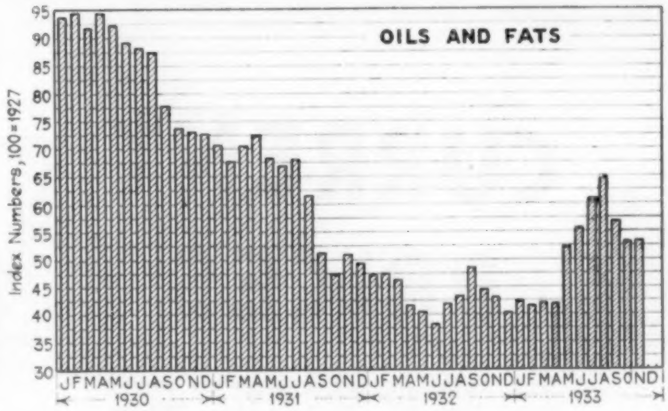
Coal-Tar Crudes: Production and Sales in 1932 and 1931 and Percentages of Decrease in Production

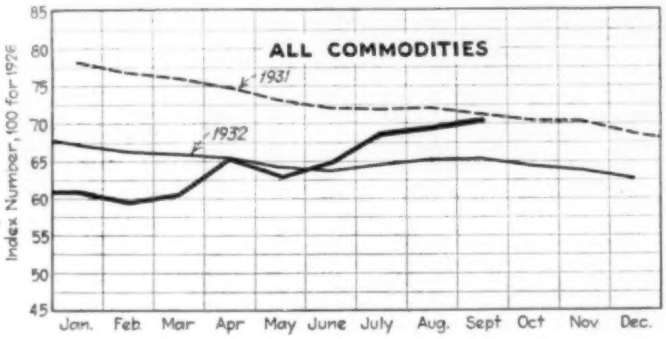
Reported by U. S. Tariff Commission

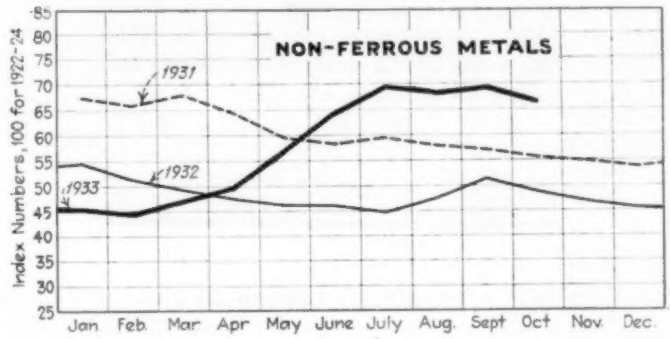
Tar distilled	1932 — Quantity—208,780,735 gal. Value—$9,376,998 — Sales: Quantity	Value	Unit Value	Production	1931 — Figures not available — Sales: Quantity	Value	Unit Value	Production	Decrease in Production in 1932 from 1931 Per Cent
Tar, gals.	222,305,219	$8,930,643	$0.040	303,812,046	273,164,573	$12,440,567	$0.046	450,856,090	32.6
Light oil and derivatives—									
Crude light oil, gal	5,716,929	504,510	.088	75,967,346	8,739,202	710,106	.081	122,529,148	38.0
Benzene (except motor benzol) gals.	11,907,550	2,147,946	.180	11,441,665	14,267,081	2,209,839	.155	14,772,297	22.5
Motor benzol, gals.	34,136,464	4,024,907	.118	34,226,635	61,471,006	7,209,157	.117	61,960,025	44.8
Solvent naphtha, gals.	2,184,083	433,770	.199	2,411,666	3,463,950	591,628	.171	3,772,025	36.1
Other light oil products, including toluene and xylene, gals.	12,453,155	2,961,603	.238	13,913,414	16,775,280	3,669,230	.219	18,024,689	22.8
Naphthalene, crude and refined, lbs.	12,979,103	164,334	.013	13,593,202	19,554,000	262,000	.013	20,934,000	35.1
Creosote oil, gals.	60,200,632	5,594,405	.093	57,842,485	96,327,000	9,735,000	.101	105,917,000	45.4
Pitch of tar, tons	282,631	2,857,818	10.111	337,038	*	....	....	....	....
Other tar derivatives, gals.	6,401,674	672,864	.105	8,514,966	*	....	....	....	....
Phenol, gals.	90,988	18,569	.204	100,064	110,352	29,783	.270	94,097	6.3†
Tar, refined, gals.	102,628,027	8,404,232	.082	109,364,977	*	....	....	....	....

*Data for 1931 not available.
†Increase.









PRICE TRENDS—CHEM. & MET.'S WEIGHTED INDEXES

A DEFINITE trend toward higher prices for chemicals set in during the last month. Contract prices for such important selections as soda ash, caustic soda, liquid chlorine, and bleaching powder were marked higher and the higher price levels are likely to last for the next year if they are not further advanced. These advances are an indication that values are beginning to respond to the stimulus of higher production costs. Based on supply and demand there was nothing in the trading put through during the last month to influence prices. The rise in quotations was dependent solely on the higher operation costs at producing plants. The upward swing was by no means general, but all the industry codes were not in effect, and in some cases consuming demand was not active enough to encourage price advances.

The effect of processing taxes also is becoming apparent. For instance, corn oil regained some of its loss in price in recent trading, and textile and other consumers are now forced to pay more for supplies of starch and dextrine. Alcohol also will be affected by the process tax on grains. The processing tax on corn went into effect on Nov. 5 and is based on a rate of 5c. a bu. for the remainder of the month, but on Dec. 1 it will be increased to 20c. a bu. In the meantime it is probable that compensatory taxes will be levied on products which are regarded as competitive with corn.

Progress is reported for the plan to stabilize the naval stores industry with tentative approval reported by the legal division of AAA. When the agreement becomes effective shipments will be made under an allotment control which should eliminate price-cutting competition.

Leading soap manufacturers reduced prices for some of their finished products during the last month. Retailers stocked up heavily some time ago and recent price concessions were given in order to hold up sales volume. It is true that some soap makers are well supplied with different low-priced raw materials, but replacement costs have been going up in the last two weeks and the finished products must ultimately be influenced in the same direction.

The Department of Agriculture issued a report on Nov. 10 placing yield of flaxseed in 1933 at 7,451,000 bu. This represents the smallest crop since 1919, and the yield per acre—4.2 bu.—was the smallest on record. This indicates that more dependence than usual must be placed on imported seed and with exchange and import duties to be considered there is not much hope for low-priced linseed oil for the next year.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1927

This month	**86.82**
Last month	86.05
November, 1932	84.61
November, 1931	85.98

Higher prices for soda ash, caustic soda, chlorine, and turpentine had the effect of moving the price index upward. Anhydrous ammonia was available at lower prices. Contract prices for borax and potash salts are repeated at the 1933 figure.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1927

This month	**53.11**
Last month	53.07
November, 1932	43.15
November, 1931	50.99

Vegetable oils declined in price early in the period, but were on a rising scale at the close, with the index number slightly higher. Exchange has been a factor in strengthening oils from foreign markets.

CURRENT PRICES

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Nov. 15.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums, lb	$0.10 -$0.10½	$0.08½-$0.09	$0.10 -$0.11
Acid, acetic, 28%, bbl., cwt	2.90 - 3.15	2.90 - 3.15	2.65 - 2.90
Glacial 99%, drums	10.02 -10.27	10.02 -10.27	8.89 -......
U. S. P. reagent, c'bys	10.52 -10.77	10.52 -10.77	9.64 - 9.89
Boric, bbl., lb	.04½- .05	.04½- .05	.04½- .05
Citric, kegs, lb	.29 - .31	.29 - .31	.29 - .31
Formic, bbl., lb	.11 - .11½	.11 - .11½	.10 - .11
Gallic, tech., bbl., lb	.60 - .65	.60 - .65	.50 - .55
Hydrofluoric 30% carb., lb	.07 - .07½	.07 - .07½	.06 - .07
Latic, 44%, tech., light, bbl., lb.	.11½- .12	.11½- .12	.11½- .12
22%, tech., light, bbl., lb	.05½- .06	.05½- .06	.05½- .06
Muriatic, 18° tanks, cwt	1.00 - 1.10	1.00 - 1.10	1.00 - 1.10
Nitric, 36°, carboys, lb	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18.50 -20.00	18.50 -......	18.50 -20.00
Oxalic, crystals, bbl., lb	.11 - .11½	.11 - .11½	.11 - .12
Phosphoric, tech., c'bys., lb	.09 - .10	.09 - .10	.08½- .09
Sulphuric, 60°, tanks, ton	11.00 -11.50	11.00 -11.50	11.00 -11.50
Sulphuric, 66°, tanks, ton	15.50 -......	15.50 -......	15.50 -......
Tannic, tech., bbl., lb	.23 - .35	.23 - .35	.23 - .35
Tartaric, powd., bbl., lb	.25 - .25½	.24½- .25	.22 - .23
Tungstic, bbl., lb	1.40 - 1.50	1.40 - 1.50	1.40 - 1.50
Alcohol, ethyl, 190 p'f., bbl., gal.	2.415-......	2.415-......	2.53½-......
Alcohol, Butyl, tanks, lb	.095-......	.095-......	.113-......
Alcohol, Amyl.	......-......	......-......	......-......
From Pentane, tanks, lb	.15 -......	.15 -......	.182-......
Denatured, 190 proof			
No. 1 special dr., gal	.33½-......	.33½-......	.34½-......
No. 5, 188 proof, dr., gal	.34 -......	.34 -......	.38½-......
Alum, ammonia, lump, bbl., lb	.03 - .04	.03 - .04	.03 - .04
Chrome, bbl., lb	.04½- .05	.04½- .05	.04½- .05
Potash, lump, bbl., lb	.03 - .04	.03 - .04	.03 - .04
Aluminum sulphate, com., bags, cwt	1.25 - 1.40	1.25 - 1.40	1.25 - 1.40
Iron free, bg., cwt	1.90 - 2.00	1.90 - 2.00	1.90 - 2.00
Aqua ammonia, 26°, drums lb.	.02½- .03	.02½- .03	.02½- .03
tanks, lb.	.02½- .02¾	.02½- .02¾	.02½- .02¾
Ammonia, anhydrous, cyl., lb	.14 - .14½	.15½- .15¾	.15½- .15¾
tanks, lb	.05 -......	.05 -......	.05½-......
Ammonium carbonate, powd. tech., casks, lb	.08 - .12	.08 - .12	.10 - .11
Sulphate, wks., cwt	1.20 -......	1.20 -......	1.025-......
Amylacetate tech., tanks, lb., gal	.14½-......	.14½-......	.16 -......
Antimony Oxide, bbl., lb	.08½- .10	.08½- .10	.07 - .08
Arsenic, white, powd., bbl., lb	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs, lb	.14 - .14½	.13 - .14	.09 - .10
Barium carbonate, bbl., ton	56.50 -58.00	56.50 -58.00	56.50 -58.00
Chloride, bbl., ton	74.00 -75.00	61.50 -65.00	63.00 -65.00
Nitrate, cask, lb	.08½- .09	.07½- .07½	.07 - .07½
Blanc fixe, dry, bbl., lb	.03½- .04	.03½- .04	.03½- .04
Bleaching powder, f.o.b., wks., drums, cwt	1.85 - 2.00	1.75 - 2.00	1.75 - 2.00
Borax, grain, bags, ton	40.00 -45.00	40.00 -45.00	40.00 -45.00
Bromine, cs., lb	.36 - .38	.36 - .38	.36 - .38
Calcium acetate, bags	3.00 -......	3.00 -......	2.50 -......
Arsenate, dr., lb	.07 - .08	.07 - .08	.05½- .06½
Carbide drums, lb	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks., ton.	17.50 -......	17.50 -......	18.00 -......
flake, dr., wks., ton.	19.50 -......	19.50 -......	21.00 -......
Phosphate, bbl., lb	.07½- .08	.07½- .08	.08 - .08½
Carbon bisulphide, drums, lb	.05½- .06	.05½- .06	.05 - .06
Tetrachloride drums, lb	.05½- .06	.05½- .06	.06½- .07
Chlorine, liquid, tanks, wks., lb.	.0185-......	.01½-......	.01½-......
Cylinders	.05½- .06	.05½- .06	.05 - .06
Cobalt oxide, cans, lb	1.15 - 1.25	1.15 - 1.25	1.25 - 1.35

	Current Price	Last Month	Last Year
Copperas, bgs., f.o.b. wks., ton.	14.00 -15.00	14.00 -15.00	13.00 -14.00
Copper carbonate, bbl., lb	.08½- .16	.08½- .16	.07 - .16
Cyanide, tech., bbl., lb	.39 - .44	.39 - .44	.39 - .44
Sulphate, bbl., cwt	3.75 - 4.00	3.75 - 4.00	3.00 - 3.25
Cream of tartar, bbl., lb	.18 - .18½	.17½- .18	.17 - .17½
Diethylene glycol, dr., lb	.14 - .16	.14 - .16	.14 - .16
Epsom salt, dom., tech., bbl., cwt.	2.10 - 2.15	2.10 - 2.15	1.70 - 2.00
Imp., tech., bags, cwt	2.00 - 2.10	2.00 - 2.10	1.15 - 1.25
Ethyl acetate, drums, lb	.08½-......	.08½-......	.10 -......
Formaldehyde, 40%, bbl., lb	.06 - .07	.06 - .07	.06 - .07
Furfural, dr., contract, lb	.10 - .17½	.10 - .17½	.10 - .17½
Fusel oil, crude, drums, gal	.75 -......	.75 -......	1.10 - 1.20
Refined, dr., gal	1.25 - 1.30	1.25 - 1.30	1.80 - 1.90
Glaubers salt, bags, cwt	1.00 - 1.10	1.00 - 1.10	1.00 - 1.10
Glycerine, c.p., drums, extra, lb.	.10½- .10¾	.10½- .10¾	.10½- .10¾
Lead:			
White, basic carbonate, dry casks, lb	.06½-......	.06½-......	.06½-......
White, basic sulphate, sck., lb.	.06 -......	.06 -......	.06 -......
Red, dry, sck., lb	.07½-......	.08 -......	.06½-......
Lead acetate, white crys., bbl., lb.	.10½- .11	.10½- .11	.10 - .11
Lead arsenate, powd., bbl., lb	.10 - .13	.10 - .13	.10 - .14
Lime, chem., bulk, ton	8.50 -......	8.50 -......	8.50 -......
Litharge, pwd., csk, lb	.06¾-......	.07 -......	.05½-......
Lithophone, bags, lb	.04½- .05	.04½- .05	.04½- .05
Magnesium carb., tech., bags, lb.	.06 - .06½	.06 - .06½	.05½- .06
Methanol, 95%, tanks, gal	.33 -......	.33 -......	.33 -......
97%, tanks, gal	.34 -......	.34 -......	.34 -......
Synthetic, tanks, gal	.35½-......	.35½-......	.35½-......
Nickel salt, double, bbl., lb	.12 - .12½	.12 - 12½	.10½- .11
Orange mineral, csk., lb	.10½-......	.10½-......	.09½-......
Phosphorus, red, cases, lb	.45 - .46	.45 - .46	.42 - .44
Yellow, cases, lb	.28 - .32	.28 - .32	.28 - .32
Potassium bichromate, casks, lb.	.07½- .08	.07½- .08	.08 - .08½
Carbonate, 80-85%, calc. csk., lb	.07 - .07½	.06½- .07	.05 - .06
Chlorate, powd., lb	.08½- .08¾	.08½- .08¾	.08 - .08½
Hydroxide (c'stic potash) dr., lb.	.07½- .07¾	.07½- .07¾	.06½- .06¾
Muriate, 80% bgs., ton	37.15 -......	37.15 -......	37.15 -......
Nitrate, bbl., lb	.05½- .06	.05½- .06	.05½- .06
Permanganate, drums, lb	.17½- .18	.17½- .18	.16 - .16½
Prussiate, yellow, casks, lb	.16½- .17	.16½- .17	.18½- .19
Sal ammoniac, white, casks, lb	.04½- .05	.04½- .05	.04½- .05
Salsoda, bbl., cwt	1.00 - 1.05	.90 - .95	.90 - .95
Salt cake, bulk, ton	13.00 -15.00	13.00 -15.00	13.00 -15.00
Soda ash, light, 58%, bags, contract, cwt	1.23 -......	1.20 -......	1.15 -......
Dense, bags, cwt	1.25 -......	1.22½-......	1.17½-......
Soda, caustic, 76%, solid, drums, contract, cwt	2.60 - 3.00	2.50 - 2.75	2.50 - 2.75
Acetate, works, bbl., lb	.04½- .05	.04½- .05	.05 - .05½
Bicarbonate, bbl., cwt	1.85 - 2.00	1.85 - 2.00	1.85 - 2.00
Bichromate, casks, lb	.05 - .05½	.05 - .05½	.05 - .06
Bisulphate, bulk, ton	14.00 -16.00	14.00 -16.00	14.00 -16.00
Bisulphite, bbl., lb	.03 - .04	.03 - .04	.03½- .04
Chlorate, kegs, lb	.05½- .07½	.05½- .07½	.05½- .07½
Chloride, tech., ton	12.00 -14.75	12.00 -14.75	12.00 -14.00
Cyanide, cases, dom., lb	.15½- .16	.15½- .16	.15½- .16
Fluoride, bbl., lb	.07½- .08	.07½- .08	.07½- .08
Hyposulphite, bbl., lb	2.40 - 2.50	2.40 - 2.50	2.40 - 2.50
Metasilicate, bbl., cwt	3.25 - 3.40	3.25 - 3.40	3.60 - .75
Nitrate, bags, cwt	1.295-......	1.295-......	1.245-......
Nitrite, casks, lb	.07½- .08	.07½- .08	.07½- .08
Phosphate, dibasic, bbl., lb	.02½- .023	.02- .023	.0255 - .0275
Prussiate, yel. drums, lb	.11½- .12	.11½- .12	.11½- .12
Silicate (40° dr.) wks. cwt	.70 - .75	.70 - .75	.70 - .75
Sulphide, fused, 60-62%, dr., lb.	.02½- .03½	.02½- .03	.02¾- .03
Sulphite, cyrs., bbl., lb	.02½- .02¾	.02½ .02¾	.03 - .03½
Sulphur, crude at mine, bulk, ton	18.00 -......	18.00 -......	18.00 -......
Chloride, dr., lb	.03½- .04	.03½- .04	.03½- .04
Dioxide, cyl., lb	.06½- .07	.06½- .07	.06½- .07
Flour, bag, cwt	1.55 - 3.00	1.55 - 3.00	1.55 - 3.00
Tin Oxide, bbl. lb	.52 -......	.50 -......	.27½-......
Crystals, bbl., lb	.40 -......	.35½-......	.24 -......
Zinc chloride, gran., bbl., lb	.05½- .06	.05½- .06	.06½- .06¾
Carbonate, bbl., lb	.09½- .11	.09½- .11	.10½- .11
Cyanide, dr., lb	.38 - .42	.38 - .42	.41 - .42
Dust, bbl., lb	.07 - .07½	.07 - .07½	.04½- .05
Zinc oxide, lead free, bag, lb	.05½-......	.05½-......	.05½-......
5% lead sulphate, bags, lb	.05½-......	.05½-......	.05½-......
Sulphate, bbl., cwt	3.00 - 3.25	3.00 - 3.25	3.00 - 3.25

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb	$0.09½-$0.10	$0.09½-$0.10	$0.09½-$0.10
Chinawood oil, bbl., lb	.08 -......	.07½-......	.05½-......
Coconut oil, Ceylon, tanks, N. Y. lb	.03½-......	.03 -......	.03½-......
Corn oil crude, tanks, (f.o.b. mill), lb	.04 -......	.04½-......	.03½-......
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.03½-......	.03½-......	.03 -......
Linseed oil, raw car lots, bbl., lb	.097-......	.101-......	.067-......
Palm, Lagos, casks, lb	.04 -......	.04½-......	.03½-......
Palm Kernel, bbl., lb	.04 -......	.04 -......	.04½-......
Peanut oil, crude, tanks (mill), lb.	.03½-......	.04 -......	.03½-......
Rapeseed oil, refined, bbl., gal	.42 - .43	.50 - .52	.33 - .34
Soya bean, tank, lb	.06½-......	.07 -......	......-......
Sulphur (olive foots), bbl., lb	.06½-......	.06 -......	.04½-......
Cod, Newfoundland, bbl., gal	.33 - .35	.31 - .32	.21 - .26
Menhaden, light pressed, bbl., lb;	.053-......	.053-......	.04½-......
Crude, tanks (f.o.b. factory), gal.	.13 -......	.17 -......	.09½-......
Grease, yellow, loose, lb	.02½-......	.02½-......	.02½-......
Oleo stearine, lb	.05½-......	.05½-......	.05½-......
Red oil, distilled, d.p. bbl., lb	.06½-......	.06½-......	.06½-......
Tallow, extra, loose, lb	.03 -......	.03½-......	.02½-......

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb..	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl., lb.	.80 - .85	.80 - .85	.80 - .85
Alpha-naphthylamine, bbl., lb..	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.14½- .15	.14½- .15	.14½- .15
Aniline salts, bbl., lb.	.24 - .25	.24 - .25	.24 - .52
Benzaldehyde, U.S.P., dr., lb.	1.10 - 1.25	1.10 - 1.25	1.10 - 1.25
Benzidine base, bbl., lb.	.65 - .67	.65 - .67	.65 - .67
Benzoic acid, U.S.P., kgs, lb.	.48 - .52	.48 - .52	.48 - .52
Benzyl chloride, tech., dr., lb.	.30 - .35	.30 - .35	.30 - .35
Benzol, 90%, tanks, works, gal..	.22 - .23	.22 - .23	.20 - .21
Beta-naphthol, tech., drums, lb..	.22 - .24	.22 - .24	.22 - .24
Cresol, U. S. P., dr., lb.	.10½- .11	.10½- .11	.10½- .11
Cresylic acid, 97%, dr., wks., gal.	.45 - .46	.45 - .46	.49 - .52
Diethylaniline, dr., lb.	.55 - .58	.55 - .58	.55 - .58
Dinitrophenol, bbl., lb.	.29 - .30	.29 - .30	.29 - .30
Dinitrotoluen, bbl. lb.	.16 - .17	.16 - .17	.16 - .17
Dip oil 25% dr., gal.	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, bbl., lb.	.38 - .40	.38 - .40	.38 - .40
H-acid, bbl., lb.	.65 - .70	.65 - .70	.65 - .70
Naphthalene, flake, bbl., lb.	.06 - .07	.06 - .07	.03¾- .04½
Nitrobenzene, dr., lb.	.08½- .09	.08½- .09	.08½- .10
Para-nitraniline, bbl., lb.	.51 - .55	.51 - .55	.51 - .55
Phenol, U.S.P., drums, lb.	.14½- .15	.14½- .15	.14½- .15
Picric acid, bbl., lb.	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr., gal.	.90 - .95	.90 - .95	1.50 - 1.80
R-salt, bbl., lb.	.40 - .44	.40 - .44	.40 - .44
Resorcinal, tech., kegs, lb.	.65 - .70	.65 - .70	.65 - .70
Salicylic acid, tech., bbl., lb.	.40 - .42	.40 - .42	.33 - .35
Solvent naphtha, w.w., tanks, gal.	.26 -......	.26 -......	.26 -......
Tolidine, bbl., lb.	.88 - .90	.88 - .90	.86 - .88
Toluene, tanks, works, gal.	.30 -......	.30 -......	.30 -......
Xylene, com., tanks, gal.	.26 -......	.26 -......	.26 -......

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton...	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb.	.12½- .13	.14 - .15	.06- .10½
China clay, dom., f.o.b. mine, ton	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors:			
Carbon gas, black (wks.), lb...	.02¾- .20	.02¾- .20	.02¾- .20
Prussian blue, bbl., lb.	.35 - .36	.35 - .36	.35 - .36
Ultramine blue, bbl., lb.	.06 - .32	.06 - .32	.06 - .32
Chrome green, bbl., lb.	.26 - .27	.26 - .27	.27 - .30
Carmine red, tins, lb.	3.65 - 3.75	3.65 - 3.75	3.90 - 4.50
Para toner, lb.	.80 - .85	.80 - .85	.75 - .80
Vermilion, English, bbl., lb.	1.35 - 1.40	1.35 - 1.40	1.25 - 1.50
Chrome yellow, C. P., bbl., lb.	.15 - .15½	.15 - .15½	.16 - .16½
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb.	.07 - .08½	.07 - .08½	.07 - .08½
Gum copal Congo, bags, lb.	.08 - .09	.08 - .09	.06 - .08
Manila, bags, lb.	.09 - .10	.09 - .10	.16 - .17
Damar, Batavia, cases, lb.	.15 - .15½	.15 - .15½	.16 - .16½
Kauri No. 1 cases, lb.	.20 - .25	.20 - .25	.45 - .48
Kieselguhr (f.o.b. N.Y.), ton...	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton.	50.00 -......	50.00 -......	40.00 -......
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H., bbl.	5.15 -......	5.05 -......	3.90 -......
Turpentine, gal.	.48½-......	.46½-......	.45¾-......
Shellac, orange, fine, bags, lb.	.24 - .25	.24 - .25	.20 - .25
Bleached, bonedry, bags, lb...	.24 - .25	.24 - .25	.18 - .19
T. N. bags, lb.	.13 - .14	.13 - .14	.10½- .11½
Soapstone (f.o.b. Vt.), bags, ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton..	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
300 mesh (f.o.b Ga.), ton.	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.), ton..	13.75 -....	13.75 -.....	13.75 -.....
Wax, Bayberry, bbl., lb.	.15 - .16	.15 - .16	.16 - .20
Beeswax, ref., light, lb.	.22 - .27	.22 - .27	.20 - .30
Candelilla, bags, lb.	.09 - .09½	.09 - .09½	.12 -......
Carnuba, No. 1, bags, lb.	.27 - .29	.27 - .29	.26 -......
Paraffine, crude			
105-110 m.p., lb.	.04 -......	.04 -......	.03½- .03¾

Price Changes During Month

Advanced	Declined
Soda ash	Ammonia, anhydrous
Caustic soda	Red lead
Chlorine	Litharge
Tartaric acid	
Turpentine	
Rosin	
Bleaching powder	
Tin salts	

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%, ton.	$200.00-.....	$200.00-.....	$200.00-.....
Ferromanganese, 78-82%, ton.	82.00-.....	82.00-.....	68.00-.....
Ferrochrome, 65-70%.	.09½-....	.09½-.....	.10-.....
Spiegeleisen, 19-21% ton.	27.00-.....	27.00-.....	25.00-.....
Ferrosilicon, 14-17%, ton.	31.00-.....	31.00-.....	31.00-....
Ferrotungsten, 70-80%, lb.	1.05- 1.20	.95- 1.00	1.00- 1.10
Ferrovanadium, 30-40%, lb.	2.60- 2.80	2.60- 2.80	3.05- 3.40

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic, lb.	$0.08½-......	$0.08½-......	$0.05½-......
Aluminum, 96-99%, lb.	.229-......	.229-......	.229-......
Antimony, Chin. and Jap., lb.	.072-......	.07 -......	.055-......
Nickel, 99%, lb.	.35 -......	.35 -......	.35 -......
Monel metal blocks, lb.	.28 -......	.28 -......	.28 -......
Tin, 5-ton lots, Straits, lb.	.55 -......	.48½-......	.236-......
Lead, New York, spot. lb.	.043-......	.045 -......	.0315-......
Zinc, New York, spot, lb.	.0485-......	.0512-......	.037 -
Silver, commercial, oz.	.45 -......	.39½-......	.27 -......
Cadmium, lb.	.55 -......	.55 -......	.55 -......
Bismuth, ton lots, lb.	1.20 -......	1.20 -......	.85 -......
Cobalt, lb.	2.50 -......	2.50 -......	2.50 -......
Magnesium, ingots, 99%, lb.	.32 -......	.32 -......	.30 -......
Platinum, ref., oz.	36.00 -......	36.00 -......	33.00 -......
Palladium, ref., oz.	21.00 -......	21.00 -	18.00 - 19.00
Mercury, flask, 75 lb.	66.00 -......	66.00 -......	49.00 -......
Tungsten powder, lb.	1.25 -......	1.25 -......	1.45 -......

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks., ton.	$6.50 -$8.25	$6.50 -$8.25	$6.50 -$8.25
Chrome ore, c.i.f. ports, ton.	16.00 -20.00	16.00 -20.00	17.00 -20.00
Coke, fdry., f.o b. ovens, ton.	2.25 -......	2.25 -......	3.25 - 3.75
Fluorspar, gravel, f.o.b. Il., ton...	17.25 -20.00	17.25 -20.00	17.25 -20.00
Manganese ore, 50% Mn., c.i.f. Atlantic Ports, unit.	.19 -......	.19 - ...	.23 -......
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y., lb.	.45 -......	.45 -......	.45 -......
Monazite, 6% of ThO_2, ton.	60.00 -......	60.00 -......	60.00 -......
Pyrites, Span. fines, c.i.f., unit.	.13 -......	.13 -......	.13 -......
Rutile, 94-96% TiO_2, lb.	.10 - .11	.10 - .11	.10 - .11
Tungsten, scheelite, 60% WO_3 and over, unit.	12.00 -......	12.00 -......	10.00 -10.50

INDUSTRIAL NOTES

STEEL AND TUBES, INC., Cleveland, Ohio, has transferred A. V. Grove from Cleveland to handle the sales department of the Chicago district. J. F. Keeler is now sales engineer of the company with headquarters at Cleveland.

ALLOY PRODUCTS CORP., Waukesha, Wis., has appointed the following new representatives: H. P. MacGregor, Railway Exchange Bldg., St. Louis, for Missouri, northern Illinois and southern Kansas; W. F. Norton, 5506 Euclid Ave., Cleveland, for northern Ohio and western New York; E. W. Buschman, 626 Broadway, Cincinnati, for southern Ohio, Kentucky, and parts of Indiana, Virginia, and Tennessee.

T. SHRIVER & Co., Harrison, N. J., has appointed The Merrill Co., 343 Sansome St., San Francisco, Calif., as sales representatives in the Rocky Mountain and Pacific Coast areas.

NORTHERN EQUIPMENT Co., Erie, Pa., announces the appointment of the C. J. Gaskell Co. as its representative in Memphis, Tenn.

AMERICAN CYANAMID Co., New York, has acquired the Filtration Equipment Corp. which owns the Laughlin equipment and process of sewage treatment.

THE DURIRON Co., Dayton, Ohio, has made D. Augsburger manager of its Boston office. He succeeds E. D. Brauns who has been transferred to Philadelphia.

THE BLAW-KNOX Co., Pittsburgh, Pa., has installed a coppersmithing shop at its plant in Blawnox, Pa., and will take up the fabrication of copper equipment.

PANGBORN CORP., Hagerstown, Md., announces the appointment of Ralph M. Trent as sales engineer for the Pittsburgh territory. His headquarters are at 604 Chamber of Commerce Bldg., Pittsburgh, Pa.

THE BAKER CASTOR OIL Co., New York, has developed a new series of castor oil derivatives which are high boiling alkyl ricinoleates.

NORTHERN PUMP Co., Minneapolis, Minn., has elected Hugh L. Rusch vice-president of the company and appointed him eastern sales manager with headquarters in the Chrysler Bldg., New York City.

RAYMOND BROS. Impact Pulverizer Co., announces the organization of a metallurgical division for supplying a full line of coal pulverizing, transporting and burning equipment for complete powdered fuel installations. This new department is under the direction of C. F. Herington with headquarters at the Chicago office of the company.

NEW CONSTRUCTION

Where Plants Are Being Built in Process Industries

	This Month		Cumulative to Date	
	Proposed Work and Bids	Contracts Awarded	Proposed Work and Bids	Contracts Awarded
New England	....	$50,000	$504,000	$215,000
Middle Atlantic	$763,000	570,000	7,784,000	4,756,000
Southern	163,000	85,000	12,284,000	7,248,000
Middle West	25,000	68,000	1,625,000	1,089,000
West of Mississippi	995,000	63,000	14,459,000	14,155,000
Far West	190,000	....	4,780,000	2,844,000
Canada	913,000	2,540,000	6,466,000	2,899,000
Total	$3,049,000	$3,376,000	$47,902,000	$33,206,000

PROPOSED WORK BIDS ASKED

Ammunition Depot—U. S. Government, 8th Corps Area, Fort Sam Houston, Tex., acquired 1,370 acres at Camp Stanley Military Reservation for ammunition area at San Antonio Arsenal, to include ammunition depots, magazines, storehouses, etc. Estimated cost $900,000.

Powder Factory—U. S. Government, Bureau Yards & Docks, Washington, D. C., is having plans prepared for 2 story, brick, powder factory at Indian Head, Md. Estimated cost $75,000.

By-Products Plant—Lemieux Charcoal Co., Ltd., Weedon, Que., plans the construction of a plant for distillation of wood and manufacture of by-products.

Chemical Plant—Port Hardy Pulp & Paper Co., Ltd., Port Hardy, B. C., plans the construction of a wood distillation and chemical plant. Estimated cost $225,000.

Chemical Plant — Rostrom Chemical Co., Woodstock, Ont., Thomas Rostrom, Mgr., plans to establish a chemical plant. Estimated cost $40,000.

Clay Products Plant—Ontario Clay Products Syndicate, J. D. Grant, Mgr., Oshawa, Ont., manufacturer of tile, fire brick, and fire clay products, plans to establish a plant here.

Concentrator Plant — The Bonanza Concentractor Co., 1438 Beechwood Drive, Los Angeles, Calif., has purchased a site at Pico and Soto Sts., Los Angeles, and plans the construction of a 1 story, 195x200 ft. concentrator plant (new type gold ore dry concentrator.) Estimated cost $45,000.

Concentrator—Noranda Mines, Ltd., Noranda, Que., plans to increase capacity of concentrator at mines from 2,000 to 3,000 tons per day. New equipment will be required to increase percentage of recovery of gold. Estimated cost $500,000. E. Hibbert is consulting engineer.

Phosphate Mill — Idaho Phosphate Mining Co., San Francisco, Calif., Fred S. Irvin, Pres., plans the construction of a phosphate fertilizer mill on its property at Paris, Idaho. Estimated cost $20,000.

Factory—The New Process Co., Warren, Pa., plans to rebuild its factory destroyed by fire. Estimated cost $500,000.

Gas Plant—City, Cherryvale, Kan., defeated bond election to construct municipal gas plant. Estimated cost $80,000.

Laboratory—Federal Emergency Administration of Public Works, Washington, D. C., has announced an allotment of $14,500 to complete the Rocky Mountain Spotted Fever Laboratory at Hamilton, Mont.

Laboratory Building—U. S. Government, Constructing Quartermaster Dept., Port Monmouth, N. J., is having plans prepared for the construction of a 3 story laboratory building for the Signal Corps. Estimated cost $160,000.

Laboratory—Vancouver School Board, Memorial Hall, Vancouver, Wash., plans the construction of an addition to the high school building, to include a laboratory. W. H. Higgins, Terminal Sales Bldg., Portland, Ore., and D. J. Stewart, Seattle, Wash., are architects.

Oil Refinery — Pennsylvania Refining Co., Titusville, Pa., plans to extend its refinery, on Brown St. Estimated cost $28,000.

Oil Refinery — Pierce Petroleum Corp., Tampico, Mex., and 45 Nassau St., New York, N. Y., plans to reconstruct refineries at Tampico and on south bank of river opposite Tampico, recently damaged by hurricane. Surveys now being made to determine extent of damage and nature of reconstruction work. Estimated cost to exceed $100,000.

Oil Refinery—Roosevelt Oil Co., Mt. Pleasant, Mich., plans to replace 25 steel storage tanks at its refinery recently destroyed by fire.

Oil Refinery—Victory Oil Co., Guy L. Deems, Pres., 738 Perdido St., New Orleans, La., is having plans prepared for a chemical research laboratory, including processing and packing equipment, in St. Bernard Parish. Estimated cost $75,000.

Refinery Equipment—Wentworth Refineries, Ltd., Burlington St., Hamilton, Ont., are interested in prices of refining stills, storage tanks, centrifugal pumps and boiler, for new plant.

Oil Refinery—White Petroleum & Refining Co., R.F.D. 4, Cambridge Springs, Pa., plans to enlarge its refinery in Hickory Town Rd., Allegheny Township, Venango Co. Estimated cost to exceed $28,000.

Rayon Mill—The Blue Ridge Rayon Mills, Altavista, Va., represented by Spencer Love, Burlington, N. C., plan the construction of additions to their mills, including the installation of 830 looms.

Rayon Mill—Canadian Celanese Co., Ltd., 465 Bay St., Toronto, Ont., plans additions and extensions to its mill. Estimated cost exceeds $28,000.

Rayon Mill—Southern Silk Mills, Greensboro, N. C., plans the construction of a silk and rayon mill at Kernersville, N. C. Estimated cost $30,000.

Silk Mill—Wardi Silk Mills, 14 East 33rd St., New York, N. Y., and 338 Mountain Rd., Union City, N. J., has acquired the plant of the Seidman Braid & Fabric Co., Huntsville, Ala., and will equip same for the manufacture of silk underwear. Estimated cost, including equipment, $28,000.

Tannery—A. Davis & Son, 407 Rideau St., Kingston, Ont., plans the construction of a 3 story, 50x200 ft. tannery. Estimated cost $60,000. Margeson & Babcock, 210 Dundas St. W., Toronto, are engineers.

Varnish Works—W. P. Fuller Co., 301 Mission St., San Francisco, Calif., plans to rebuild its plant recently destroyed by fire. Estimated cost $125,000.

Wood Products Plant—Provincial Wood Products, Ltd., St. Nicholas St., Montreal, Que., plans the construction of a plant for the manufacture of wood products.

CONTRACTS AWARDED

Chemical Plant — Chemical Pigments Co., Pennsylvania R.R. tracks and St. Helena Ave., Baltimore, Md., awarded contract for 1 story, 70x80 ft. addition to plant to Price Construction Co., Maryland Trust Bldg., Baltimore.

Cooperage Works—National Pressure Cooper Co., 1515 Bale St., Eau Claire, Wis., awarded contract for factory to Olson & Walker, 304 Barstow St., Eau Claire. Estimated cost $40,000.

Factory—Aluminum Specialty Co., 17th and Woolwer Sts., Manitowoc, Wis., awarded contract for 1 story, 40x60 ft. factory, to Kasper Construction Co., 4 North 8th St., Manitowoc.

Factory—John A. Lang & Sons Leather Co., 231 Albert St., Kitchener, Ont., awarded contract for 2 story, 80x140 ft. and 1 story, 20x80 ft. plant, brick additions to Oscar Wiles, Maurice St., Kitchener. Owner plans to equip building with special plant for the manufacture of gloves.

Leather Storage Plant — Bayer-Robertson Leather Corp., 101 Golden St., Newark, N. J., awarded contract for 1 story leather storage plant to W. J. MacEvoy Construction Co., 85 Academy St., Newark. Estimated cost, including equipment, $28,000.

Fertilizer Plant—Apothecaries Hall Co., Benedict St., Waterbury, Conn., awarded contract for plant at Broadbrook, Conn., to Bartlett-Brainard Co., 16 Vandyke Ave., Hartford, Conn. Estimated cost $50,000.

Laboratory—Congoleum-Nairn, Inc., 195 Belgrove Drive, Kearny, N. J., awarded contract for laboratory and office building to Eustice Bros., 879 Frelinghuysen Ave., Newark, N. J. Estimated cost, including equipment, $28,090.

Laboratory—Trubek Laboratory, State Highway, East Rutherford, N. J., awarded contract for 1 story, 45x70 ft. laboratory, to David Manser, 33 Humboldt St., Woodbridge, N. J. Estimated cost $28,500.

Oil Refinery—Alkot Petroleum Co., Chase, Kan., plans the construction of an oil refinery. Estimated cost $35,000. Separate contracts are now being awarded.

Oil Refinery—Joseph and Fred Whitaker, 1376 East 26th St., Tulsa, Okla., have acquired refinery at Garber, Okla., and plan to repair and alter same. Estimated cost $28,000. Work will be done by day labor.

Paper Mill—Sonoco Products, Inc., 709 West Front St., Plainfield, N. J., awarded contract for 2 story addition to paper mill on North Ave., Garwood, N. J., to Wigton-Abbott Corp., 705 Park Ave., Plainfield. Estimated cost $28,500.

Paper Plant—Superior Paper Products Co., Carnegie, Pa., awarded contract for 1 story brick and steel paper plant, to Rust Engineering Co., Koppers Bldg., Pittsburgh. Estimated cost $250,000.

Rayon Mill—American Enka Corp., Asheville, N. C., awarded contract for first addition to proposed $500,000 mill to Potter & Shackleford, Greenville, S. C. Estimated cost $85,000.

Rayon Mill—Courtaulds Canada, Ltd., Cornwall, Ont., awarded contract for 2 story, 150x500 ft. addition to its mill to Foundation Co. of Canada, 151 Harbour St., Toronto. Estimated cost $2,500,000.

Shoe Polish Factory—Griffin Mfg. Co., Willoughby and Walworth Sts., Brooklyn, N. Y., plans to alter its 8 story factory, including the construction of a chimney. Owner is now awarding separate contracts for the work.

Soap Factory—Colgate Palmolive Peet Co., W. W. McCall, Division Mgr., 105 Hudson St., Jersey City, N. J., awarded contract for altering and building 2 story top addition to factory at Hudson and York Sts., to Turner Construction Co., 420 Lexington Ave., New York, N. Y. Estimated cost $150,000.

EXHIBITOR-ADVERTISER SECTION

Fourteenth

EXPOSITION CHEMICAL INDUSTRIES

★

Grand Central Palace

New York City

WEEK OF DECEMBER 4th

1933

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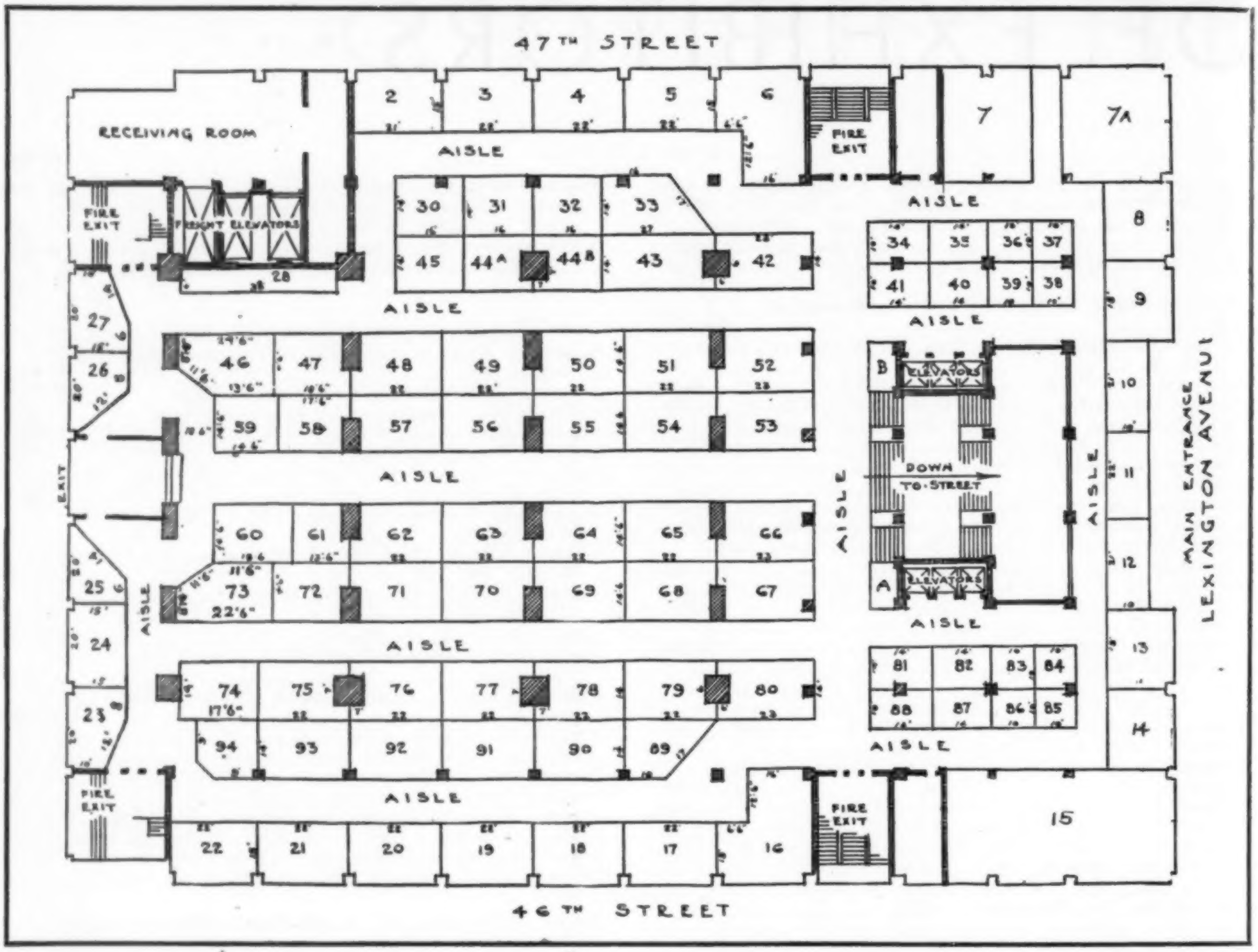

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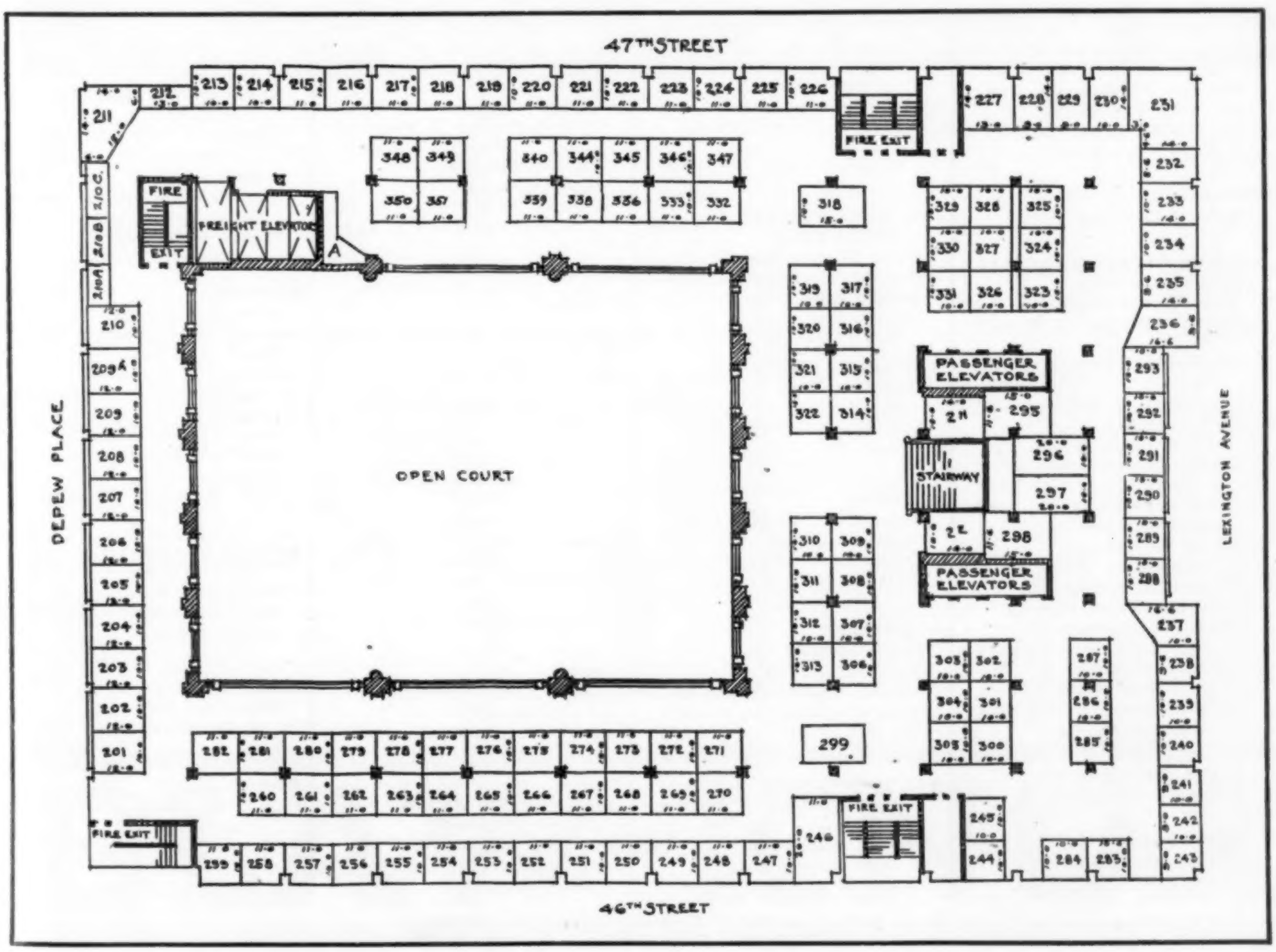

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Edward Ermold Company
Ertel Engineering Corp.
Reeves Pulley Co.
Volumeter Co., Inc.

BREW HOUSE EQUIPMENT
Buffalo Foundry & Machine Co.

BRICK—Acid Proof
Electro Chemical Supply & Engrg. Co.
General Ceramics Co.
Maurice A. Knight
Stebbins Engineering & Mfg. Co.
U. S. Stoneware Company.

BRICK—Insulation
Johns-Manville Corp.
Binney & Smith Co.

BRIQUETTING & TABLET MAKING MACHINERY
Fred S. Carver
Reeves Pulley Co.
Robinson Mfg. Co.
F. K. Stokes Machine Co.

BUCKETS
Manganese Steel Forge Co.
Robinson Mfg. Co.
Shelley-Heins Cooperage Co.

BUILDING MATERIALS
Bakelite Company
Electro Chemical Supply & Engrg. Co. (acid proof)
John A. Roebling's Sons Co.

CABINETS
Laboratory Furniture Co., Inc.
Schwartz Sectional System
E. H. Sheldon & Co.

CALCINERS
Blaw-Knox Company
Hardinge Company

CALIORIMETERS
American Meter Co.
Central Scientific Co.
Eimer & Amend
Fansteel Products Co.

CANS
Carpenter Container Co.
Container Company (fibre)
Wheeling Corrugating Co.

CARBON
Commercial Solvents Corp.
Darco Sales Company (activated)
Eastman Kodak Company
Industrial Chemical Sales Co. (activated)
Linde Air Products Co. (activated)

CARBOY STOPPERS
Maurice A. Knight (acid proof, porous)

CARBOY TILTERS
Eimer & Amend.

CARS—Tank
Blaw-Knox Company
Hauser Stander Tank Co. (rubber lined)
Pfaudler Company

CASE SEALING MACHINES
Burt Machine Company

CASTINGS
Buffalo Foundry & Machine Co. (gray iron, chemical)
Catalazuli Mfg. Co. (phenolic)
Duriron Company (corrosion resisting)
Hardinge Company (iron, chilled iron)
Lebanon Steel Foundry (stainless steel of chromium & chromium nickel for valves, fittings, mixers)
National Radiator Co. (corrosion & heat resistant)
Parker Appliance Co. (brass, bronze, aluminum, nickel-alloys)
William Powell Company (valve)
Rochester Engineering & Centrifugal Corp.

CAUSTICIZERS
Turbo Mixer Corp.

CAUSTIC POTS
Buffalo Foundry & Machine Co.

CELLULOSE
Eastman Kodak Company (acetate)
Hercules Powder Company

CEMENT
Binney & Smith Co. (insulating)
Electro Chemical Supply & Engrg. Co. (acid proof)
General Ceramics Company
General Plastics, Inc.
Haveg Corporation (acid resistant)
Johns-Manville Corp. (refractory, insulating)
Maurice A. Knight (acid proof)
Stebbins Engineering & Mfg. Co. (acid proof)
U. S. Stoneware Company (acid proof)

CENTRIFUGALS
Eimer & Amend
Fletcher Works
Lead Lined Iron Pipe Co.
Pfaultz & Bauer
Rochester Engineering & Centrifugal Co.
Sharples Specialty Company
Tolhurst Machine Works
DeLaval Separator Co.

CERAMICS
Electro Chemical Supply & Engrg. Co.
General Ceramics Co.
Maurice A. Knight
Stebbins Engineering & Mfg. Co.
U. S. Stoneware Company

CHEMICAL PLANT EQUIPMENT
Abbe Engineering Company
Alsop Engineering Company
Amersil Company
Blaw-Knox Company
Buffalo Foundry & Machine Co.
Beach Russ Company
Carpenter Container Co.
Corning Glass Works
DeLaval Separator Co.
Dorr Company
Duriron Company
Electro Chemical Supply & Engrg. Co.
Ertel Engineering Corp.
Fansteel Products Co.
General Ceramics Co.
General Electric Co.
B. F. Gump Company
Hardinge Company
Haveg Corporation
Maurice A. Knight
Lead Lined Iron Pipe Company
Manton Gaulin Mfg. Co., Inc.
Merco Nordstrom Valve Co.
National Radiator Company
Newark Wire Cloth Co.
New England Tank & Tower Co.
Oliver United Filters Co.
Pfaudler Company
Pioneer Cooperage Co.
Pulverizing Machinery Co.
Pittsburgh Equitable Meter Co.
Reeves Pulley Co.
Robinson Mfg. Co.
Scientific Glass Apparatus Co.
Stebbins Engineering & Mfg. Co.
F. J. Stokes Machine Co.
Swenson Evaporator Co.
Turbo Mixer Corporation
U. S. Stoneware Company

CHEMICAL STONEWARE—Acid Proof
General Ceramics Co.
Monarch Mfg. Works
Stebbins Engineering & Mfg. Co.
U. S. Stoneware Company

CHEMICALS—Industrial
Commercial Solvents Corp.
Cleveland Cliffs Iron Co.
Dow Chemical Co.
Electro Bleaching Gas Co. (bleaching powder, para dichloro benzine, orotho dichloro benzine)
Electro Chemical Supply & Engrg. Co. (sulphur dioxide, colloidal sulphur, formaldehyde dust, chlorpicrin)
Eastman Kodak Company
Exolon Company
Glyco Products Company
Hercules Powder Company
Industrial Chemical Sales Co. (calcium carbonate)
Linde Air Products Co.
Niagara Alkali Company
Pfaltz & Bauer
Charles Pfizer Co. (see classification list)
Quaker Oats Company
Sharples Solvents Corp.
Virginia Smelting Co. (SO_2, Methyl Chloride "Vaso" (liquid stripping agent) VasCo — Preservatives, zinc sulphate 80%)

CHEMICALS—Laboratory
Central Scientific Co.
Eimer & Amend
Eastman Kodak Company
Electro Chemical Supply & Engrg. Co. (sulphur dioxide, colloidal sulphur, formaldehyde dust, chlorpicrin)
Ohio Chemical Co.
Pfaltz & Bauer
Pioneer Cooperage Corp.
Charles Pfizer Co. (see classification list)
Quaker Oats Company
Scientific Glass Apparatus Co.

CHEMICALS—Photographic
Eastman Kodak Company

CHEMISTS—Consulting
Foster D. Snell, Inc.

CO_2 RECORDERS
Brown Instrument Company
Eimer & Amend
Foxboro Company

CLARIFIERS
Dorr Company
Fletcher Works
Hardinge Company
Oliver United Filters, Inc.
Rochester Engineering & Centrifugal Co.
Sharples Specialty Company
DeLaval Separator Co.

COKE OVEN MACHINERY
Reeves Pulley Company

COLLECTORS
Raymond Bros. Impact Pulv. Co.
Robinson Mfg. Co.

COLLOID MILLS
Eimer & Amend
Manton-Gaulin Mfg. Co.
Premier Mill Corp.

COLORIMETERS
Eimer & Amend
Laboratory Furniture Co., Inc.
Carl Zeiss, Inc.

COLORS—Dry
Pulverizing Machinery Co.

COMPRESSORS
Abbe Engineering Company
Beach-Russ Company
General Electric Company
Oliver United Filters, Inc.
Schutte & Koerting Co.

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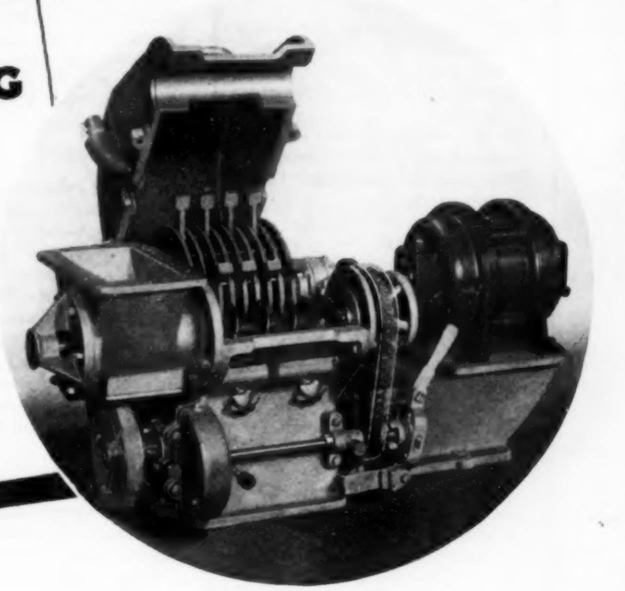
PULVERIZERS SEPARATORS

RAYMOND 1ST IN MAKING *Fine Chemicals* SINCE 1887



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PROGRESS and service have maintained Raymond leadership in the chemical industry for close to half a century. Today, the advanced features of Raymond equipment are enabling manufacturers to simplify processes and meet exacting specifications of quality products.

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Drying — Kiln Mills, or Air Drying Pulverizers, offer the most economical method known for handling wet materials. By removing moisture and reducing the material in one continuous process, they show big savings over separate units of equipment in *drying and grinding* filter-press products and similar materials.

Write for descriptive bulletins, mentioning your product and problem. **Raymond Bros., Impact Pulverizer Co.,** 1311 N. Branch Street, Chicago. Sales offices in New York and Los Angeles.

Small capacity Mechanical Air Separator, equipped with patented whizzer. For extreme uniformity and fineness to 350-mesh and better.

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RAYMOND

PULVERIZING, SEPARATING, AIR DRYING AND DUST COLLECTING EQUIPMENT

EXHIBITORS ★ *Classified by Products* ★ CONTINUED

CONCENTRATORS
Swenson Evaporator Company.

CONDENSERS
Abbe Engineering Co.
Beach-Russ Company
Blaw-Knox Company
Buffalo Foundry & Machine Co.
Corning Glass Works
Eimer & Amend
Fansteel Products Co.
General Ceramics Company
General Electric Co.
Maurice A. Knight
Leeds & Northrup
National Radiator Co.
Oliver United Filters, Inc.
Pfaudler Company
Pioneer Cooperage Co.
F. J. Stokes Machine Co.
Schutte & Koerting Co.
Swenson Evaporator Co.

CONSULTING CHEMISTS
Foster D. Snell, Inc.

CONTACTORS
Blaw-Knox Company
General Electric Company
Turbo Mixer Corporation

CONTAINERS
Arkell Safety Bag Co.
Adams Bag Company
American Bag Company
Asso. Cooperage Industries of America
Bemis Bros. Bag Co.
Buffalo Bag Company
Chase Bag Company
Cleveland-Akron Bag Co.
Container Co. (cylindrical)
Emery Carpenter Container Co.
General Ceramics Co.
General Tank Co. (wooden)
Hauser Stander Tank Co.
Jessup & Moore Paper Co.
Milwaukee Bag Co.
Muehlhausen Cooperage
Northern Bag Co.
Pfaudler Co.
Pressed Steel Tank Co.
Pioneer Cooperage Co.
Shelley-Heins Cooperage Co.
Stevens Metal Products Co.
U. S. Stoneware Co.
Union Bag & Paper Co.
Wheeling Corrugating Co.
Wilson & Bennett Mfg. Co.

CONTROLLERS
American Leter Company (liquid level, rate, volume)
Bailey Meter Co. (combustion, temperature, pressure, flow level)
Brown Instrument Company (temperature, flow, pressure, level)
Foxboro Company (temperature, pressure)
Bristol Company (air & electric, indicating, cycle, single, four and six cam, free vane, air operated)
General Electric Co.
Leeds & Northrup Company
Podbielniak Laboratories
Reeves Pulley Co. (speed)
Sarco Company (temperature)

CONVEYING MACHINERY & EQUIPMENT
Alsop Engineering Company
Audubon Wire Cloth Company (felts)
Cambridge Wire Cloth Company
B. F. Gump Company
General Electric Company
National Engineering Company
Reeves Pulley Company
Robinson Mfg. Co.

COOLERS
Asso. Cooperage Industries of America
Blaw-Knox Company
Buffalo Foundry & Machine Co.
Corning Glass Works
Duriron Company
Fansteel Products Co. Inc.
General Ceramics Co.
General Electric Co.
Maurice A. Knight
National Radiator Co.
Pioneer Cooperage Co.
F. J. Stokes Machine Co.
Swenson Evaporator Co.
Schutte & Koerting Co.
Turbo Mixer Corp.

COOLING PONDS
Spraco, Inc.
Schutte & Koerting Co.

COOPERAGE
Asso. Cooperage Industries of America
Muehlhausen Cooperage
New England Tank & Tower Co.
Pioneer Cooperage Co.
Shelley-Heins Cooperage Co. (barrels, staves, heading, hoops)
Wheeling Corrugating Co.

COPPERSMITHING
Buffalo Foundry & Machine Co.

CORKING MACHINERY
Edward Ermold Company

COSMETIC MACHINERY
Abbe Engineering Company
Beach-Russ Company

COUPLINGS
B. F. Gump Company
Parker Appliance Company

CRUCIBLES
Amersil Company
Central Scientific Company
Eimer & Amend
Fansteel Prods. Co. (tantalum)

CRUSHERS, GRINDING MILLS & PULVERIZERS
Abbe Engineering Company
Beach-Russ Company
Central Scientific Co. (laboratory)
Eimer & Amend
B. F. Gump Co.
Hardinge Company
Jay Bee Sales Company
Pulverizing Machinery Co.
Raymond Bros. Impact Pulverizer Co.
Robinson Mfg. Co.
Williams Pat. Crusher & Pulverizer Co.

CRYSTALLING EQUIPMENT
Blaw-Knox Company
Buffalo Foundry & Machine Co.
General Ceramics Company
Hauser Stander Tank Co.
Pfaudler Company
F. J. Stokes Machine Co.
Schutte & Koerting Company
Swenson Evaporator Co.
Turbo Mixer Corp.
U. S. Stoneware Company

CYLINDERS FOR HIGH PRESSURE GASES
Matheson Company
Ohio Chemical Company
Pressed Steel Tank Co.

CYLINDERS FOR LOW PRESSURE GASES
Pressed Steel Tank Co.

DECOLORIZATION & PURIFYING MATERIALS
Darco Sales Corporation
Electro Bleaching Gas Co.
Industrial Chemical Sales Co.
Niagara Alkali Company
Schutte & Koerting Co. (deodorizing plants)

DISINTEGRATORS
Abbe Engineering Co.
Beach Russ Company

DISPERSERS
Turbo Mixer Corp.

DISSOLVERS
Abbe Engineering Co.
Beach Russ Company
Baker Perkins Company
General Ceramics Co.
New England Tank & Tower Co.
Robinson Mfg. Co.
Turbo Mixer Corp. (cellulose acetate, cotton, nitrocellulose, salt, xanthate)

DISTILLING MACHINERY & APPARATUS
Abbe Engineering Co.
Barnstead Still & Sterilizer Co.
Blaw-Knox Company
Buffalo Foundry & Machine Co.
Beach Russ Company
Corning Glass Works
DeLaval Separator Co.
Duriron Company
Eimer & Amend
General Ceramics Co.
Fansteel Products Co.
Pfaulder Company
Podbielniak Laboratories
Reeves Pulley Co.
Robinson Mfg. Co.
Scientific Glass Apparatus Co.
F. K. Stokes Machine Co.

DRUMS—Rotary-Vacuum
Abbe Engineering Co.
Blaw-Knox Company
Buffalo Foundy & Machine Co.
Beach Russ Company
Hardinge Company
Oliver United Filters, Inc.
Rochester Engineering & Centrifugal Co.
Swenson Evaporator Co.
Wheeling Corrugating Co.

DRYERS—Centrifugal
Eimer & Amend
Fletcher Works, Inc.
Rochester Engineering & Centrifugal Co.
Sharples Specialty Co.
Tolhurst Machine Works

DRYING MACHINE & EQUIPMENT
Baker Perkins Co.
Abbe Engineering Co.
Blaw-Knox Company
Buffalo Foundry & Machine Co.
Beach-Russ Company
Freas-Thermo Electric Co.
Hardinge Company
Oliver United Filters, Inc.
Proctor & Schwartz, Inc.
Reeves Pulley Company
Rochester Engineering & Centrifugal Co.
John A. Roebling's Sons Co.
F. J. Stokes Machine Co.
Swenson Evaporator Co.

DUST COLLECTING SYSTEMS
Blaw-Knox Company
Pangborn Corporation
Robinson Mfg. Company

DYES
Dow Chemical Company
Eimer & Amend
Eastman Kodak Company (fur)
Pulverizing Machinery Co.

ELECTRICAL SUPPLIES
Barnstead Still & Sterilizer Co. (steam boilers)
Bristol Company (voltmeters, ammeters, wattmeters, frequency recording)
General Electric Co.
Leeds & Northrup Co. (control apparatus)

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NEW

MIXERS · SIFTERS · PUMPS

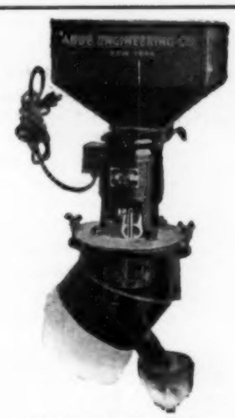
(CENTRIFUGAL) (TURBINE) (VACUUM)

Abbé New Mixer

Our Patented Abbé Blutergess Turbine Sifter introduces a new sifting principle in which the material to be sifted is passed through a specially designed turbine, revolving on a vertical axis at relatively high speed. This action causes the material to strike the screen in a finely divided state. Tremendous capacities with small floor space, small screening area and using little power. Screens changed in few minutes.

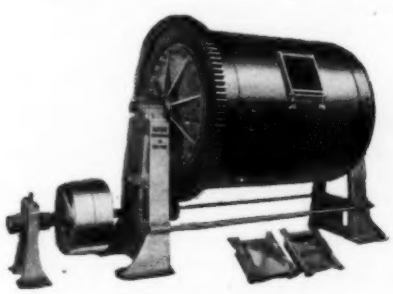
Beach-Russ Vacuum and Pressure Pump

Rapid and intensive, low power, small floor space, simplicity of operation in our new Patented Abbé Lenart Centrifugal Mixer. Especially adapted for mixing, emulsifying or dissolving liquids or pastes, or for blending or mixing dry powders. Sizes from 1 to 1000 gal., either plain or jacketed.



Abbé Patented Sifter

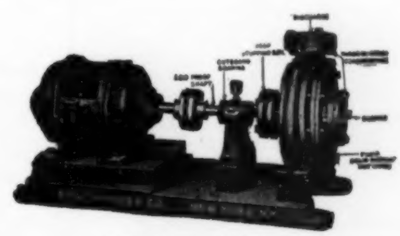
Above illustrates new type CF automatically lubricated laboratory pump direct connected to motor with flexible coupling. Operates from lamp socket. All mounted on 12 gal. receiver. Ideal for either vacuum to 29½" or pressures to 30 lb. Runs absolutely quiet. We also manufacture pumps with capacities to 500 cu.ft. per minute and for vacuum up to 1/10 of a micron.



Abbé Pebble Mill

Abbé Rima Wedge Wire Slit Sieves are used for dewatering, filtering, drying, classification, washing, etc.

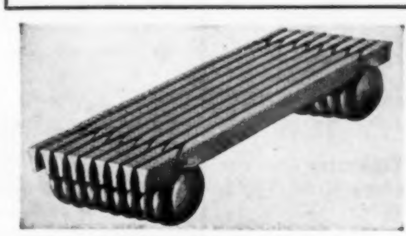
We also stock a complete ine of reinforced wire cloth and imported Dufour Silk Bolting Cloth.



Beach-Russ Acid Pump

Abbé Pebble and Ball Mills are built in large number of sizes for wet or dry grinding and mixing. Made with porcelain, silex, steel or rubber lining.

The Abbé one piece porcelain Jar Mills are ideal for laboratory work.



Abbé Rima Wedge Wire Slit Sieve

ACID RESISTING PUMPS

Constructed of either hard lead-antimony alloy, monel metal, nickel, Allegheny metal, bronze, aluminum or stainless steel. Pumps are cast solid (not lined), having thru bolt construction, making their period of service unlimited. Made in various capacities. Also pumps for heavy liquids.

PRODUCTS

Pulverizers, Grinders, Mixers, Sifters and Screens, High Vacuum Pumps, Rotary Air Compressors, Gas Boosters and Liquid Pumps

ABBÉ ENGINEERING CO. – BEACH-RUSS CO.

CHURCH ST., NEW YORK

Boston - Baltimore - Buffalo - Chicago - Cleveland - Akron - Los Angeles

EXHIBITORS ★ *Classified by Products* ★ CONTINUED

ELECTROLYTIC CELLS
Westvaco Chlorine Products Co.

ELEVATORS
B. F. Gump Company (bucket)
General Electric Co.
Lewis-Shepard Company
National Engineering Corp.
Robinson Mfg. Co.

EMULSIFIERS
Abbe Engineering Co.
Beach Russ Company
National Radiator Co. (petroleum treaters)
Turbo Mixer Corp.

ENAMELED APPARATUS
Alsop Engineering Co. (glass coated tanks)
General Electric Co.
Pfaudler Company (glass lined steel)

EVAPORATORS
Blaw-Knox Company
Abbe Engineering Co.
Buffalo Foundry & Machine Co.
Beach Russ Company
General Ceramics Co.
Fansteel Products Co.
F. J. Stokes Machine Co.
Swenson Evaporator Co.
Turbo Mixer Corp.

EXHAUSTERS
Duriron Company
General Ceramics Co.
Schutte & Koerting Co.
U. S. Stoneware Company

EXPLOSIVES
Hercules Powder Co.

EXTRACTION PLANTS
Blaw-Knox Company
F. K. Stokes Machine Co.

FATS & FATTY ACIDS
Glyco Products Company
Industrial Chemical Sales Co.

FEEDERS
B. F. Gump Company (blending & Mixing, chemicals, dry)

FILLING MACHINES
Alsop Engineering Co.
Ertel Engineering Corp.
B. F. Gump Co.
Pneumatic Scale Corp. (vacuum filling—all liquids)
Robinson Mfg. Co.
F. K. Stokes Machine Co.
Triangle Package Mchry. Corp. (powder)
Volumeter Company (can-drum)

FILLERS
Johns-Manville Corp. (mineral)

FILTER AIDS
Alsop Engineering Co.
Ertel Engineering Corp.
Fansteel Products Co. (cone)

Johns-Manville Corp.
Maurice A. Knight
Palo-Meyers, Inc.

FILTER CLOTH
Alsop Engineering Co.
Eimer & Amend
Oliver United Filters Co.
John A. Roebling's Sons Co.
T. Shriver Company

FILTER CLOTH—Metallic
Alsop Engineering Co.
Audubon Wire Cloth Co.
Cambridge Wire Cloth Co.
Multi Metal Wire Cloth Co.
Newark Wire Cloth Co.
Oliver United Filters, Inc.
John A. Roebling's Sons Co.

FILTER PAPER
Alsop Engineering Co.
Eimer & Amend
Oliver United Filters, Inc. (pressure & vacuum)
Palo-Meyers, Inc.
Scientific Glass Apparatus Co.
T. Shriver & Co.

FILTER PRESSES
T. Shriver & Co. (all types)

FILTERS
Alsop Engineering Co. (asbestos disc, gravity, vacuum, pressure)
Ertel Engineering Corp. (asbestos disc)
Filtration Equipment Corp. (for sewage treatment)
General Ceramics Co. (acid proof, chemical stoneware)
Hauser Stander Tank Co. (press plates & frames)
Maurice A. Knight (acid proof)
Pfaltz & Bauer (laboratory & commercial)
Sharples Specialty Co. (centrifugal)
T. Shriver & Co. (pressure)
Swenson Evaporator Co. (rotary vacuum, pressure)
U. S. Stoneware Co. (suction, filter plates—porous)

FIREPROOFING COMPOUNDS
Glyco Products Co., Inc.

FITTINGS
General Ceramics Co.
Haveg Corporation (Haveg & Celoron)
Maurice A. Knight (acid proof, porous)
Parker Appliance Co.
Stebbins Engineering & Mfg. Co.
U. S. Stoneware Co.

FLOORING
Blaw Knox Co.
Electro Chemical Supply & Engrg. Co. (acid proof)
Johns-Manville Corp.
Maurice A. Knight (acid proof)
Stebbins Engineering & Mfg. Co. (stoneware, brick, tile)
U. S. Stoneware Co.

FOOD INDUSTRIES EQUIPMENT
Abbe Engineering Co.
Beach Russ Company
Buffalo Foundry & Machine Co.
Eastman Kodak Co.
Eimer & Amend
Freas Thermo Electric Co.
B. F. Gump Co.
Manton-Gaulin Mfg. Co.
New England Tank & Tower Co.
Pfaudler Company
Pulverizing Machinery Co.
Robinson Mfg. Co.
F. J. Stokes Machine Co.
Swenson Evaporator Co.
Turbo Mixer Corp.
Union Bag & Paper Co.

FUMIGATORS
Buffalo Foundry & Machine Co.

FUMIGATING APPARATUS
F. J. Stokes Machine Co.

FUNGICIDES
Virginia Chemical Co.

FURNACES & Accessories
Eimer & Amend
Fansteel Products Co. (molybdenum wound)
General Electric Co.
Leeds & Northrup Company
Binney & Smith Co. (high temperature elec.)
Palo-Meyers, Inc.

FURFURAL
Quaker Oats Company

GAGES
American Meter Co. (volume & pressure recording, syphon)
Bailey Meter Co. (draft)
Brown Instrument Co. (indicating, recording)
Bristol Company (recording)
Central Scientific Co. (McLeod)
Foxboro Company (recording & indicating pressure)
General Electric Co.
Linde Air Products Co.
Manton-Gaulin Mfg. Co. (high pressure)
Matheson Company (pressure & vacuum)
Merco Nordstrom Valve Co. (volume, orifice)
Ohio Chemical Co. (low & high pressure, ammonia, litre)
Pittsburgh Equitable Meter Co., (pressure, recording, volume, orifice)

GAS BOOSTERS
Abbe Engineering Co.
Beach Russ Company
Merco Nordstrom Valve Co.
Pittsburgh Equitable Meter Co.
Schutte & Koerting Co.

GASES
Electro Bleaching Gas Co.
Electro Chemical Supply & Engrg. Co. (sulphur dioxide)
Linde Air Products Co. (acetylene, argon, helium, neon, nitrogen, oxygen)
Matheson Company (30 kinds)
Niagara Alkali Co.
Ohio Chemical Co.
Podbielniak Laboratories
Virginia Smelting Co. (liquid sulphur dioxide)

GAS INDICATORS
Linde Air Products Co.

GAS PURIFIERS
Blaw-Knox Company
Schutte & Koerting Co.
Turbo Mixer Corp.

GASOMETERS
Matheson Company

GEARS
Bakelite Company
Continental Diamond Fibre Co.
General Electric Co.

GLASS—Optical
Amersil Company
Corning Glass Works

GLASSWARE
Amersil Company
Central Scientific Co. (laboratory)
Corning Glass Works
Eimer & Amend
Scientific Glass Apparatus Co. (for research, automatic burrette, ground glass connectors)

GRATINGS
Blaw-Knox Company

GRAVITOMETERS
American Meter Company

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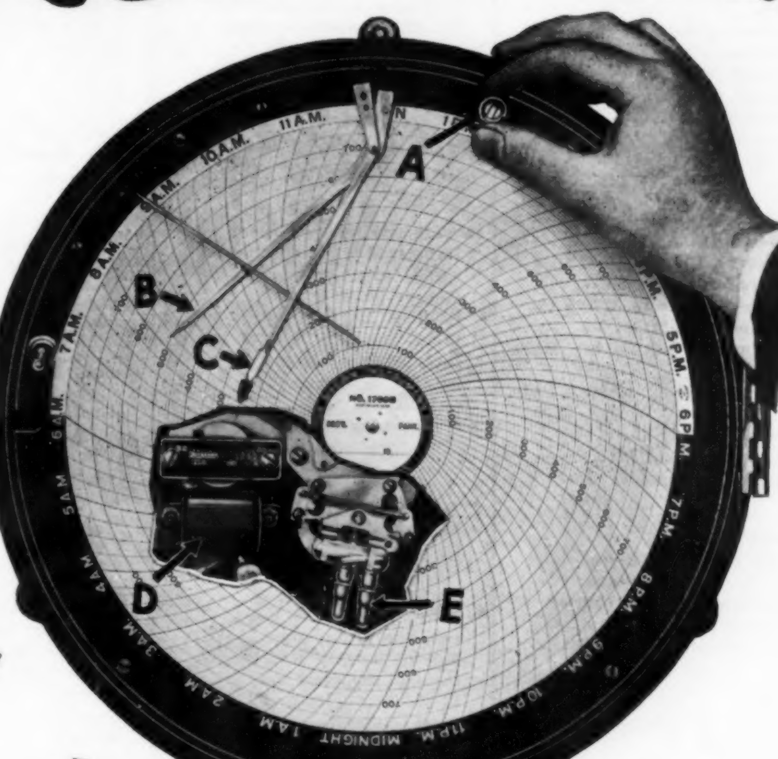
A New CONTROLLER!



No Power from Helix for Control therefore, GREATER ACCURACY-

No Strain on Pen Arm

MOTOR OPERATED MERCURY SWITCHES

Eliminate Relays *and* Exposed Contacts

THE New Brown Controller introduces a new and original principle in automatic control thermometers and pressure gauges — a principle that separates control functions from measuring functions, thus insuring greater accuracy.

The design permits of free and unhampered movement of the recording pen at all times.

An electric motor selects the switch position depending upon the temperature and control point. Switches are positive in action and mechanically positioned.

No power is required from pen assembly, and capacity of switches eliminates relays for most applications.

Many other improved features of the new Brown Control Thermometer and Pressure Gauges are standard at no extra cost; electric chart drive, toggle switch, chart hub, combination door handle and lock, die cast aluminum interchangeable case for mounting flush, front of board, on wall, bottom or back connected. Get complete information. Write for Catalog No. 6702.

THE BROWN INSTRUMENT COMPANY
4478 Wayne Avenue, Philadelphia, Pa.
Branches in 22 Principal Cities

(a) Knob for changing setting of B.
(b) Index showing temperature at which Indicating Control is set.
(c) Temperature pen.
(d) Electric motor selects switch position depending upon relation of C to B.
(e) Mercury in glass switches, capacity 15 amperes at 110 volts, positive in action, are mechanically positioned by Motor D. No power required from pen. Eliminate relays in most applications.

Write for Catalog No. 6702

See this new controller at Chemical Show Booths 40 and 41.

The New BROWN THERMOMETER

To Measure is to Economize

EXHIBITORS ★ *Classified by Products* ★ CONTINUED

HEAT EXCHANGERS
Blaw-Knox Company
Buffalo Foundry & Machine Co.
Duriron Company
Fansteel Products Co.
General Electric Co.
Parker Appliance Co.
National Radiator Co.
Schutte & Koerting Co.
Turbo Mixer Corp.

HEATING SYSTEMS & ACCESSORIES
Baker Perkins Co.
General Electric Co.
Merco Nordstrom Valve Co.
National Radiator Co.
Pittsburgh Equitable Meter Co.
Raymond Bros. Impact Pulv. Co.
Reeves Pulley Co.
Sarco Company
Schutte & Koerting Co.

HOMOGENIZERS
Abbe Engineering Co.
Beach Russ Company
Chemicolloid Laboratories
Eimer & Amend
Manton-Gaulin Mfg. Co.

HOODS
Maurice A. Knight
Spraco, Inc.
E. H. Sheldon & Co.

HUMIDIFYING APPARATUS
Freas Thermo Electric Co.
General Electric Co.
Spraco, Inc.

HYDROGEN ION APPARATUS
Central Scientific Co.
Eimer & Amend
Hellige, Inc.
Leeds & Northrup
Palo-Meyers, Inc.
Pfaltz & Bauer (electric & colorimetric types)
W. A. Taylor & Co., Inc.

HYDROGENATORS
Turbo Mixer Corp.

HYDROMETERS
Matheson Co.

IMPREGNATING APPARATUS
Buffalo Foundry & Machine Co.
F. J. Stokes Machine Co. (vacuum)

INDICATORS
Bailey Meter Co. (draft, pressure, temperature)
Eimer & Amend
Foxboro Company
General Electric Vapor Lamp Co.
Linde Air Products Co. (combustible gas)
Leeds & Northrup Co.
Parker Appliance Co. (flow)
Pfaltz & Bauer (for hydrogen ion determination)
Podbielniak Laboratories
W. A. Taylor & Co. Inc. (chemical)
Schutte & Koerting Co.
General Electric Co.

INSECTICIDES
Virginia Smelting Co.

INSTRUMENTS—Optical
Bausch & Lomb Optical Co.
Eimer & Amend
Hellige, Inc.
Leeds & Northrup Co.
Leitz, Inc., E.
Palo-Meyers, Inc.
Pfaultz & Bauer
Carl Zeiss, Inc. (retractometers, interferometers, photometers

INSTRUMENTS—Testing
Bailey Meter Co.
Bausch & Lomb Optical Co.
Brown Instrument Co.
Central Scientific Co.
Eimer & Amend
Foxboro Company
Freas Thermo Electric Co.
General Electric Co.
Leeds & Northrup Co.
Leitz, Inc., E.
Linde Air Products Co.
Newark Wire Cloth Co. (sieves, sieve shaking machines)
Palo-Meyers, Inc.
Pfaltz & Bauer (Fluorescence, chemical, mineralogical, biological, saccharimeters)
Podbielniak Laboratories
W. A. Taylor & Co. Inc.
Carl Zeiss, Inc.

INSULATING MATERIAL Heating, Electric & Moulded
Bakelite Corp.
Continental Diamond Fibre Co.
General Plastics, Inc.
General Electric Co.
Johns-Manville Corp.
Leeds & Northrup Company
Quaker Oats Company
John A. Roebling's Sons Co.
Binney & Smith Co.

INSULATORS—Furnace
Johns-Manville Corp.
Binney & Smith Co.

KEGS
Asso. Cooperage Industries of America (wooden)
Shelley-Heins Cooperage Co.

KETTLES
Baker Perkins Co. (wooden)
Blaw-Knox Co. (mixing)
Buffalo Foundry & Machine Co. (cast iron, sheet steel, nickel clad, stainless)
Duriron Company (corrosion resisting)
Fansteel Products Co. (tantalum lined)
General Ceramics Co. (acid proof, chemical stoneware)
Maurice A. Knight (acid proof)
Pfaudler Company (glass-lined steel reaction)
Rochester Engineering & Centrifugal Co. (copper, monel metal, Mechanite cast iron)

KILNS
Blaw-Knox Company (rotary)
Hardinge Company (rotary)

LABORATORY APPARATUS & SUPPLIES
Abbe Engineering Co.
Alsop Engineering Co.
American Meter Co.
Amersil Company
Bausch & Lomb Optical Co.
Beach Russ Company
Carpenter Container Co.
Central Scientific Co.
Corning Glass Works
Christian Becker
Eimer & Amend
Fletcher Works, Inc.
Freas Thermo Electric Co.
Fansteel Products Co.
General Ceramics Co.
Hellige Co., Inc.
Maurice A. Knight
Leeds & Northrup Co.
Manton-Gaulin Mfg. Co.
Newark Wire Cloth Co.
National Engineering Corp.
Ohio Chemical Co.
Pfaltz & Bauer
Pfaudler Co.
Palo-Meyers, Inc.
Podbielniak Laboratories
Reeves Pulley Co.
Seederer-Kohlbusch, Inc. (balances)
Scientific Glass Apparatus Co.
E. H. Sheldon Co.
Tolhurst Machine Works
Turbo Mixer Corp.
U. S. Stoneware Co.
Carl Zeiss, Inc.
Baker & Company
Fred S. Carver

LABORATORIES—Testing
Central Scientific Co.
Dorr Company
Duriron Company
Leitz, Inc., E.
Oliver United Filters, Inc.
Podbielniak Laboratories

LABORATORY FURNITURE
General Ceramics Co.
Maurice A. Knight
Laboratory Furniture Co., Inc.
Matheson Company
Schwartz Sectional System
E. H. Sheldon & Co.

LABELLING MACHINES
Burt Machine Co.
Edward Ermold Company
McDonald Engineering Co.
Pneumatic Scale Co. (semi & fully automatic for round and rectangular packages)
Reeves Pulley Co.

LACQUERS
Celluloid Corp.

LAMPS
General Electric Co.
General Electric Vapor Lamp Co.
Palo-Meyers, Inc.

LEAD BURNING & COATING
Hauser Stander Tank Co.
Lead Lined Iron Pipe Co.

LIGHTING APPARATUS
General Electric Co.
General Electric Vapor Lamp Co.
Linde Air Products Co.

LIME—Chemical and Hydrated
American Lime & Stone Co.
Eimer & Amend
Pulverizing Machinery Co.

LININGS
Arkell Safety Bag Co. (for bags, barrels, drums, boxes)
Stebbins Engineering & Mfg. Co. (corrosion resisting)
U. S. Stoneware Co. (acid proof)

LOADERS
National Engineering Co.

MAGNETIC SEPARATORS
Exolon Company
B. F. Gump Company
Robinson Mfg. Co.
Williams Pat. Crusher & Pulverizer Co.

MATERIALS HANDLING EQUIPMENT
Audubon Wire Cloth Co.
Carpenter Container Co.
Continental Diamond Fibre Co.
B. F. Gump Co.
Lewis-Shepard Co. (elevating trucks, skid platforms, racks for barrels & drums, drain stands, carboy pourers)
Hardinge Company
Reeves Pulley Co.
Robinson Mfg. Co.
Yale & Towne Mfg. Co.

MECHANICAL SEPARATORS
Raymond Bros. Impact Pulv. Co.

METAL COATING AND PLATING
General Plastics, Inc. (protective varnish coatings)
Lead Lined Iron Pipe Co.
Wheeling Corrugating Co.

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EXHIBITORS ★ *Classified by Products* ★ CONTINUED

METAL CONTAINERS
Pressed Steel Tank Co.
Wheeling Corrugating Co.

METALS
Baker & Company
Dow Chemical Co.
Eimer & Amend
General Alloys Co. (alloys)
Fansteel Products Co. (tantalum, tungsten, molybdenum, ceasium, rubidium)
International Nickel Co. (nickel & nickel alloys, Monel, Inconel, Ni-Resist)
Illinois Steel Co. (steel & alloy steel)
Linde Air Products Co.
John A. Roeblings Sons Co.
U. S. Steel Company (steel and alloy steel)
Virginia Smelting Co. (zinc dust)

METERS
American Meter Co. (gas and air, wet and dry test meters, flow, orifice)
Bailey Meter Co. (flow)
Bristol Co. (recording)
Eimer & Amend
General Electric Company
Leeds & Northrup
Merco Nordstrom Valve Co. (water, oil, gasoline, grease, liquid, positive displacement, disc or orifice type)
Pittsburgh Equitable Meter Co. (water, oil, gasoline, grease, liquid, positive displacement, disc or orifice type)
Schutte & Koerting Co. (flow)

MICROSCOPES
Bausch & Lomb Optical Co.
Eimer & Amend
Leitz, Inc., E.
Pfaltz & Bauer

MILLS
Abbe Engineering Co. (pebble, ball, paint, grinding, porcelain jar, tube, laboratory, jacketed)
Beach Russ Co. (pebble, ball, paint, grinding, porcelain jar, tube, laboratory, jacketed)
Eimer & Amend
General Ceramics Co. (acid proof, chemical stoneware)
B. F. Gump Co. (hammer)
Manton-Gaulin Mfg. Co.
Pulverizing Machinery Co. (fine grinding)
Robinson Mfg. Co.
Turbo Mixer Corporation (paint)
U. S. Stoneware Company (jar and ball)
Williams Patent Crusher & Pulverizer Co. (roller, air separation, hammer, dryer)
Carl Zeiss, Inc.
Chemicolloid Laboratories, Inc. (colloid)

MINERALS
Eimer & Amend

MIXERS
Abbe Engineering Co.
Beach Russ Company
B. F. Gump Company (continuous)

MIXING MACHINERY & EQUIPMENT
Alsop Engineering Co.
Abbe Engineering Co.
Baker Perkins Co.
Blaw-Knox Company
Beach Russ Company
Chemicolloid Laboratories, Inc.
Electro Chemical Supply & Engrg. Co. (portable cement mixer)
General Ceramics Co.
B. F. Gump Co.
Jay Bee Sales Co.
Manton-Gaulin Mfg. Co.
Mixing Equipment Co.
National Engineering Co.
New England Tank & Tower Co.
Pfaudler Company
Pulverizing Machinery Co.
Reeves Pulley Company
Robinson Mfg. Co.
F. J. Stokes Machine Co.
Turbo Mixer Corp.

MOTORS
Louis Allis Company (splash proof, explosion proof, totally enclosed, fan cooled)
General Electric Co.
Reeves Pulley Co.

NAVAL STORES
Hercules Powder Co.
Industrial Chemical Sales Co.
Maurice A. Knight
Quaker Oats Co.

NITRATORS
Blaw-Knox Company
Buffalo Foundry & Machine Co.
General Ceramics Co.
Maurice A. Knight
Turbo Mixer Company

NOZZLES
Baker & Company
Maurice A. Knight
Monarch Mfg. Works
Oliver United Filters, Inc.
Parker Appliance Co.
Spraco, Inc.
Schutte & Koerting Co.
U. S. Stoneware Company

OILS & GREASES
Matheson Company (refrigerating)
Pfaltz & Bauer (lanolin, degras, wool grease)
Quaker Oats Company

OIL TREATING SYSTEM
National Radiator Co. (emulsion)
Turbo Mixer Company

OVENS—Electric Laboratory
Eimer & Amend
Freas Thermo Electric Co.
Palo-Meyers, Inc.

OVENS—Industrial
Baker Perkins Company
Central Scientific Co.
Freas Thermo Electric Co.
General Electric Co.

OXIDIZERS
Turbo Mixer Company

PACKAGING EQUIPMENT
Burt Machine Co.
Carpenter Container Co.
Edward Ermold Company
B. F. Gump Company
Karl Kiefer Machine Co.
Pneumatic Scale Co. (sealing, filling, wrapping)
Reeves Pulley Co.
F. J. Stokes Machine Co.
Triangle Package Machinery Co.
U. S. Bottlers Machinery Co.
Union Bag & Paper Co.
Volumeter Company
Wheeling Corrugating Co.

PACKING
Johns-Manville Corp.

PAINT MACHINERY
Abbe Engineering Co.
Beach Russ Company
Turbo Mixer Corp.

PAINT SPRAYING EQUIPMENT
Reeves Pulley Co.
Spraco, Inc.

PAPER
Arkeel Safety Bag Co. (waterproof, elastic)

PAPER MACHINERY
Abbe Engineering Co.
Beach Russ Company
Dorr Company
New England Tank & Tower Co.
Oliver United Filters, Inc.
Reeves Pulley Co., Inc.
Turbo Mixer Corporation

PERFORATED METALS
Baker & Company
B. F. Gump Company

PHARMACEUTICAL MACHINERY
Alsop Engineering Co.
Abbe Engineering Co.
Beach Russ Company
Mantin-Gaulin Mfg. Co.
Pfaudler Company
Pulverizing Machinery Co.
Robinson Mfg. Co.
F. K. Stokes Machine Co.
Turbo Mixer Corp.

PHOTOGRAPHIC EQUIPMENT
Leitz, Inc., E.

PIGMENTS
Pulverizing Machinery Co.

PIPE—Silica ware
Amersil Company
Eimer & Amend

PIPES & FITTINGS
Corning Glass Works (glass)
Continental Diamond Fibre Co.
Duriron Company (corrosion resisting)
Fansteel Products Co. (tantalum)
Haveg Corporation (Haveg & Celeron)
Johns-Manville Corp. (asbestos & cement)
Maurice A. Knight (acid proof)
Lead Lined Iron Pipe Co. (lead lined)
Merco Nordstrom Valve Co. (swivel flanges)
Pittsburgh Equitable Meter Co. (swivel flanges)
Parker Appliance Co. (tubes, brass, bronze, steel, aluminum)
Pfaudler Company (glass lined steel)
Stebbins Engineering & Mfg. Co. (stoneware)
U. S. Stoneware Company (acid proof)

PLASTIC MACHINERY
Fred S. Carver
Illinois Testing Laboratories
F. J. Stokes Machine Co.

PLASTICS
American Catalin Corp.
Bakelite Company
Catazuli Mfg. Co.
Celluloid Corp.
Commercial Solvents Co. (Resinox)
Continental Diamond Fibre Co.
Eastman Kodak Co. (lacquer base, transparent sheeting, transparent wrapping materials)
General Electric Co.
General Plastics, Inc.
Glyco Products Co.
Haveg Corp.
Hercules Powder Co.
Marblette Corp. (synthetic resin, cast phenolic resin)
Pulverizing Machinery Corp.
Quaker Oats Company

PLATINUM WARE—Sheet, Foil, Crucibles, Laboratory Ware
Baker & Company
Eimer & Amend

POLORISCOPES
Carl Zeiss, Inc.

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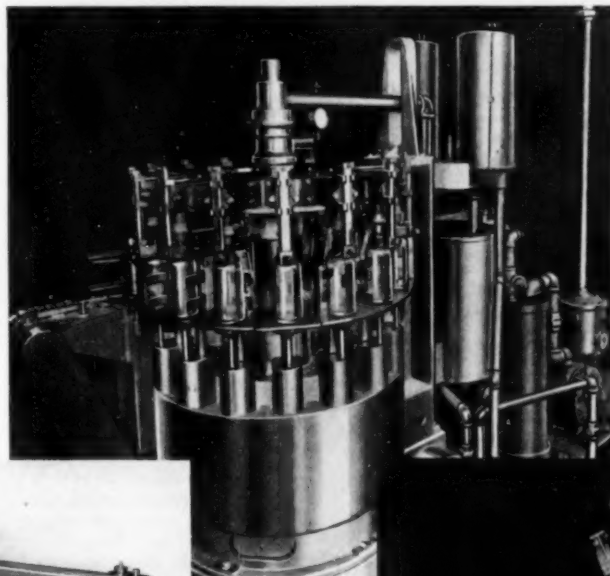
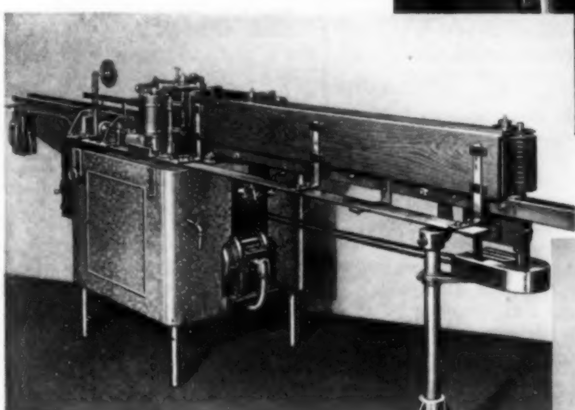
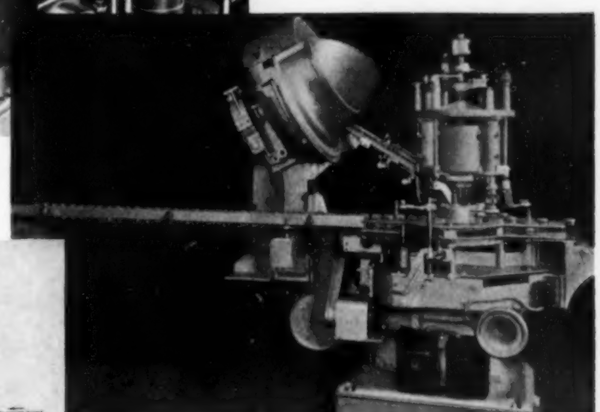
AT

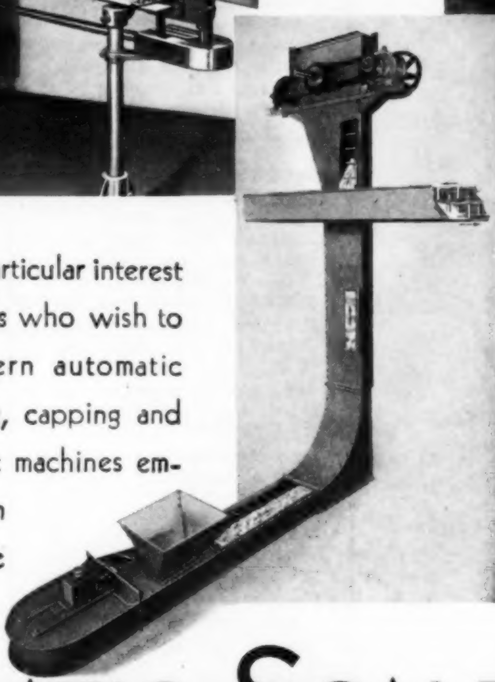
BOOTH No. 22

14TH EXPOSITION OF CHEMICAL INDUSTRIES









Booth 22 should hold particular interest to the many manufacturers who wish to keep pace with modern automatic methods of bottle filling, capping and labeling. Three Pneumatic machines embodying the latest modern improvements and the most advanced, up-to-date design will be demonstrated at Booth 22, in full operation.

A working model of the Redler Conveyor, the startling new principle of en-masse conveying, will also be on exhibition.

PNEUMATIC SCALE CORP. LTD.

82 Newport Avenue, Quincy, Mass. (Norfolk Downs Station)

Branch Offices in New York, 117 Liberty Street; Chicago, 360 North Michigan Avenue; San Francisco, 320 Market Street Melbourne, Victoria; Sydney, N. S. W. and Trafalgar House, No. 12 Whitehall; London, England

EXHIBITORS ★ *Classified by Products* ★ CONTINUED

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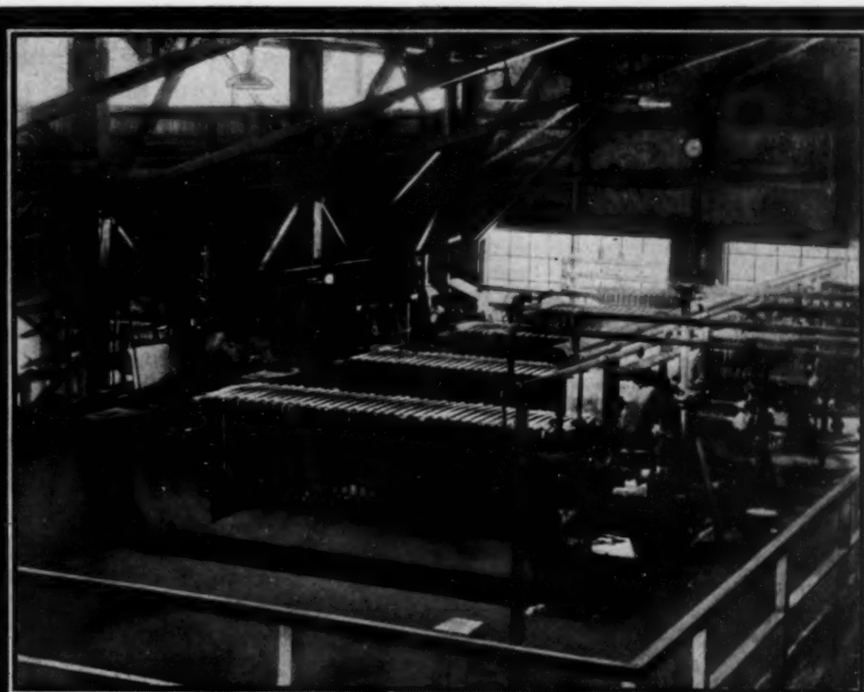
THE BEST EQUIPPED PLANTS WILL SET THE PACE



The plant with modern equipment, able to attain lower production costs, in spite of fewer working hours and costlier labor, will be the one to produce and sell at a real profit.

This applies to filtration. Makeshift methods will not do, however satisfactory they may have been in the past. Automatic methods, economically sound in the days of full time production, are frequently open to question today.

The Filter Press provides filtering area at a lower overall cost per square foot than any other filtering machine.

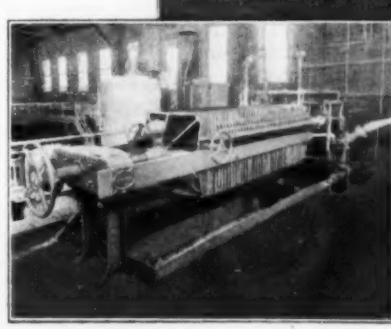
Shriver Filter Presses are thoroughly modern, completely dependable equipment capable of handling any material that can be filtered.

Drop in at our booth No. 12 during the Chemical Exposition and let us show you the advantages of Shriver Filter Presses, either as modernizing machines to meet new conditions, or as a part of a needed program of rehabilitation.

T. SHRIVER & COMPANY,
808 Hamilton Street, Harrison, New Jersey.
Western Representatives: The Merrill Co.,
343 Sansome Street, San Francisco, Cal.

THIS NEW SHRIVER BOOK

on "Modern Filtration" is now ready. Be sure to write us for your copy.



FILTER PRESSES SHRIVER DIAPHRAGM PUMPS

EXHIBITORS ★ *Classified by Products* ★ CONTINUED

SOLVENTS
Commercial Solvents Corp.
Cleveland Cliffs Iron Co.
Dow Chemical Co.
Eimer & Amend
Glyco Products Co.
Hercules Powder Co.
Podbielniak Laboratories
Quaker Oats Co.
Sharples Solvents Corp.

SPECTROSCOPES
Carl Zeiss, Inc.

SPRAY DRYING SYSTEMS
Mantin-Gaulin Mfg. Co. (pumps)

STAIR STEPS—Safety
Blaw-Knox Company

STEEL GRATING & FLOORING
Blaw-Knox Company

STERILIZERS
Barnstead Still & Sterilizer Co.
Eimer & Amend
Freas Thermo Electric Co.

STILLS
Barnstead Still & Sterilizer Co. (water & solvent recovery)
Blaw-Knox Co. (all kinds)
Buffalo Foundry & Machine Co. (fatty acid—alcohol)
Corning Glass Works (glass)
DeLaval Separator Co.
Duriron Company
Eimer & Amend
Fansteel Products Co.
General Ceramics Co. (acid proof, chemical stoneware)
Podbielniak Laboratories
F. J. Stokes Machine Co. (water & solvent)
U. S. Stoneware Company (acid proof)

STRAINERS
Maurice A. Knight
Multi Metal Wire Cloth Co.
Monarch Mfg. Works
Newark Wire Cloth Co.
John A. Roebling's Sons Co.
Sarco Company, Inc.
Spraco, Inc.
Stebbins Engineering & Mfg. Co. (stoneware)
U. S. Stoneware Co.

SULPHONATORS
Turbo Mixer Corp.

SWITCHES
General Electric Co.
General Electric Vapor Lamp Co. (mercury)

TABLET MAKING MACHINERY
Fansteel Products Co.

TACHOMETERS
Brown Instrument Co.
Bristol Company
Foxboro Company
Reeves Pulley Company

TANKS
Alsop Engineering Co. (glass coated, mixing, storage)
Abbe Engineering Co. (vacuum, pressure, oil, gas, rotary, liquid, acid)
Barnstead Still & Sterilizer Co. (distilled water)
Blaw-Knox Company (pressure)
Buffalo Foundry & Machine Co. (sheet steel cast iron)
Duriron Company
Electro Chemical Supply & Engrg. Co. (acid)
Ertel Engineering Co. (Allegheny stainless steel, glass lined)
Fansteel Products Co. (tantalum lined)
General Tank Company
General Ceramics Co. (acid proof, chemical stoneware)
Hauser Stander Tank Co. (wood & rubber lined, lead lined, wood or steel)
Haveg Corporation
Maurice A. Knight (acid proof)
New England Tank & Tower Co. (wood)
Pfaudler Company (glass lined—steel)
Pressed Steel Tank Co. (air pressure, grease dispensing, etc.)
Robinson Mfg. Co.
Spraco, Inc. (pressure container with clamp covers, & pressure control equipment)
Stebbins Engineering & Mfg. Co. (concrete)
Turbo Mixer Corp. (with agitators)
U. S. Stoneware Co. (acid proof, photographic & X-ray developing)
Filtration Equipment Corp. (for sewage treatment)

TESTING MACHINES
Eimer & Amend
W. A. Taylor & Co., Inc. (PH equipment, chlorine & phosphate control)

THERMOMETERS
Brown Instrument Co.
Bristol Company
Eimer & Amend
Foxboro Company
Illinois Testing Labs., Inc.
Leeds & Northrup Co.
Palo-Meyers, Inc.
Scientific Glass Apparatus Co.

THICKENING & DEWATERING MACHINERY
Dorr Company
Fletcher Works
Hardinge Co., Inc.
National Radiator Co.
Oliver United Filters, Inc.
Swenson Evaporator Co.

TIME RECORDERS
Bristol Company (mechanical & electric)

TOWER PACKING OR FILLING
Duriron Company
Electro Chemical Supply & Engrg. Co.
General Ceramics Co.
Maurice A. Knight
Stebbins Engineering & Mfg. Co.
U. S. Stoneware Company

TOWERS
Blaw-Knox Company
Corning Glass Works
Duriron Company
Electro Chemical Supply & Engrg Co. (acid proof)
General Ceramics Co.
Haveg Corporation
Maurice A. Knight
Stebbins Engineering & Mfg. Co.
U. S. Stoneware Company

TRANSMISSION EQUIPMENT
B. F. Gump Company
General Electric Co.
Reeves Pulley Company

TRAPS
Sarco Company (steam)

TREATERS
Turbo Mixer Corp. (gasoline, continuous)

TUBES
Carpenter Container Co. (fibre)
Corning Glass Works (glass)
Duriron Company
Fansteel Products Co. (tantalum lined)
General Ceramics Co. (acid proof, chemical stoneware)
Maurice A. Knight
Parker Appliance Co. (al. alloys—nickel)

TURBINES
General Electric Co.
New England Tank & Tower Co. (stirrers)

ULTRA VIOLET LAMPS
General Electric Vapor Lamp Co. (quartz mercury arcs)

VALVES
Duriron Company
Bristol Company (auto, electric, gas, air, steam, air operated, diaphragm regulating)
General Ceramics Co.
Maurice A. Knight (acid proof)
LaBour Company
Matheson Company
Monarch Mfg. Works (regulating)
Merco Nordstrom Valve Co.
Lead Lined Iron Pipe Co.
Pittsburgh Equitable Meter Co.
William Powell Company
Parker Appliance Company
T. Shriver Company (diaphragm)
Schutte & Koerting Co.
U. S. Stoneware Company

VENTILATORS
Johns-Manville Corp. (corrosion resisting)

VENTILATING APPARATUS
Duriron Company
General Electric Co.
General Ceramics Co.
Maurice A. Knight
E. H. Sheldon Company
U. S. Stoneware Company

VULCANIZERS
Buffalo Foundry & Machine Co.

WATER ANALYSIS EQUIPMENT
W. A. Taylor & Company

WATERPROOFING COMPOUNDS
Bakelite Corp.
Anti-Hydro Waterproofing Co.
Glyco Products Co., Inc.
Pfaltz & Bauer

WATER SOFTENING EQUIPMENT
Dorr Company

WEIGHERS
B. F. Gump Company (automatic—net)
Triangle Package Machine Co.

WIRE CLOTH
Abbe Engineering Co.
Audubon Wire Cloth Co.
Baker & Co.
Beach Russ Company
Cambridge Wire Cloth Co.
Multi Metal Wire Cloth Co.
Newark Wire Cloth Co.
Oliver United Filters, Inc.
Robinson Mfg. Co.
John A. Roebling's Sons Co.

WOOD FLOUR & FIBRE
Pulverizing Machinery Co.

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